PR-R7-03-10050

Attachment C

Project Specifications
Groundwater Circulation Well Treatment Systems and Soil Cap

Final

PROJECT SPECIFICATIONS FOR GROUNDWATER CIRCULATION WELL TREATMENT SYSTEMS AND SOIL CAP

NORTHWEST PIPE AND CASING/HALL PROCESS COMPANY SUPERFUND SITE

CLACKAMAS COUNTY, OREGON

March 2003

Prepared for:
Office of Environmental Cleanup
U. S. Environmental Protection Agency
Region 10, Oregon Operations Office
Portland, Oregon

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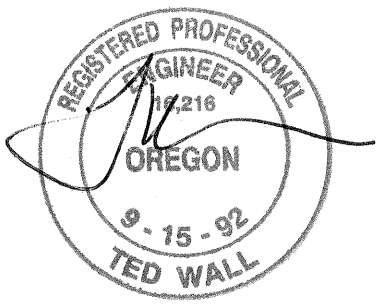
Northwest Pipe & Casing / Hall Process Company

Project Specifications For
Groundwater Circulation Well Treatment Systems
And
Soil Cap

Certification of Engineer

These specifications have been prepared under the direct supervision of the undersigned URS project engineer, whose seal, as a professional engineer licensed to practice as such, is affixed below.



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FINAL CONSTRUCTION SPECIFICATIONS
FABRICATION AND INSTALLATION OF
GROUNDWATER CIRCULATION WELL SYSTEM
AND
SOIL CAP

Northwest Pipe and Casing/Hall Process Company Site
Clackamas, Oregon

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DIVISION 1

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SECTION 01010

SUMMARY DESCRIPTION OF WORK

PART 1 GENERAL

1.1 SECTION INCLUDES

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1.2 LOCATION

A. The project is located at the former Northwest Pipe and Casing/Hall Process Company site, Clackamas, OR. The property is divided into two parcels, Parcel A and Parcel B.

B. Parcel A is the northern parcel which is bisected by Industrial Way. The western portion of Parcel A is occupied by the Oregon Department of Transportation facility and the eastern portion of Parcel A is occupied by Northwest Development Company.

C. Parcel B is the southern parcel and was the location of the former Hall Process Company operations. Parcel B is now vacant, and will be the only portion of the site receiving the Soil Cap.

1.3 PROJECT DESCRIPTION

A. This project is composed of three components: Groundwater Remediation System Installation; One Year Operation & Maintenance; and Soil Cap. During the Groundwater Remediation System Installation component, the CONTRACTOR will install a groundwater treatment system that is designed to remediate groundwater contaminated with tetrachloroethene (PCE), trichloroethene (TCE) and vinyl chloride (VC) contained in four plumes around the former Northwest Pipe and Casing/Hall Process Company site, as shown in the Project Basis of Design Report (March 2003). For the Remediation System Operation component, the CONTRACTOR will operate the remediation system installed for a one-year period. The Soil Cap component of the project will require placement of a 2 ft soil cap over Parcel B by the CONTRACTOR. The soil cap is intended to provide a physical barrier against exposure to any low-level surface soil contamination that may remain at the site.

B. The Groundwater Remediation System Installation scope of work includes installation of Groundwater Circulation Wells (GCW) and in-situ groundwater treatment systems, installation of monitoring wells, fabrication of equipment enclosures, underground piping, and necessary utilities. The scope of work also includes procurement, delivery, installation, start-up, and testing of the remediation systems.

C. The One (1) Year Operation & Maintenance scope of work includes providing all parts and labor required to operate, troubleshoot, repair, and maintain the treatment systems for a one-year period. During this period, the CONTRACTOR will be required to perform all regular and emergency maintenance on the remediation systems, and ensure that the systems are meeting the operational performance requirements of Section 1120.3.9. The CONTRACTOR shall also perform weeding and any other wetlands maintenance requirements as discussed in Section 02900.3.4.

D. The Soil Cap scope of work consists of procuring, qualifying, transporting, and placing 2-feet of soil over Parcel B. The CONTRACTOR shall place erosion control, install gravel roads, and modify the existing monitoring wells and piezometers. In addition, the CONTRACTOR shall also excavate and construct an approximately 1-acre wetlands mitigation area.

1.4 DEFINITIONS

A. Although the Oregon Department of Environmental Quality owns the Parcel B site, for the purposes of this contract and the contractual relationships herein, the words "OWNER" shall designate:

United States Environmental Protection Agency
Region 10, Oregon Operations Office
811 S.W. 6th Avenue
Portland, Oregon
Tel: (503) 326-3685
Fax: (503) 326-3399
Project Officer: Alan Goodman

B. The words “ENGINEER” or “Oversight Contractor” shall designate:

URS Corporation
111 SW Columbia, Suite 900
Portland, OR 97201
Tel: (503) 222-7200
Fax: (503) 222-4292
Project Manager: Ted Wall, PE

C. The word “CONTRACTOR” means the contracting party to whom the work is awarded. In supporting documents (e.g. Basis of Design Report), the CONTRACTOR is identified as the “Remedial Action (RA) Contractor.”

D. The letters “NWPC” shall designate Northwest Pipe and Casing/ Hall Process Company.

E. These specifications are written in imperative and streamlined form. This imperative language is directed to the CONTRACTOR, unless specially noted otherwise. The words “shall be” are included by inference where a colon (:) is used within sentences or phrases.

F. The following acronyms are commonly used throughout this document:

CFR	United States Code of Federal Regulations
EPA	Environmental Protection Agency
GCW	Groundwater Circulation Well
ODOT	Oregon Department of Transportation
OSHA	Occupational Safety and Health Administration
PAH	Polyaromatic Hydrocarbon
PCE	Perchloroethene
TCE	Tetrachloroethene
VC	Vinyl Chloride

1.5 RELATED SECTIONS

A. Section 01011 - Reference Standards.

B. Section 01300 - Submittals.

C. Section 01400 - Quality Control.

1.6 SUBMITTALS

A. Submit under provisions of Section 01300.

B. The CONTRACTOR shall submit within one (1) week of receipt of the Notice to Proceed a computer generated bar chart schedule for all components of the project. The schedule shall be sufficiently detailed to identify the period for procurement and assembly of all major components.

C. Submit all documents required under Section 01300 1.1.

D. Submit all documents under the provisions contained in Section 01300.

1.7 PROJECT SCHEDULE

A. See the Instructions to Bidders for the dates and times for:
   Prebid meeting at the site
   Bid due
   Notice of Award
   Contractor Mobilization
   Project Completion

1.8 PROJECT COORDINATION AND JOB SITE ADMINISTRATION

A. Before submitting a bid, CONTRACTOR shall examine the location and become familiar with local conditions under which the work is to be performed and correlate observations with the requirements of the Specifications.

B. CONTRACTOR shall cooperate with the OWNER as to the proper conduct of the work, and any differences of opinion shall be decided by the OWNER.

C. CONTRACTOR shall constantly supervise all the work in this contract, in person or by a duly authorized manager acceptable to the OWNER. CONTRACTOR shall always keep on the premises a foreman to direct operations and receive instruction.

D. Normal ODOT operations will continue throughout the project. The CONTRACTOR shall carefully schedule construction operations to minimize disruption of normal ODOT operations.

E. Coordination with site operations on Parcel A is provided through the OWNER's Office. Direct contact with ODOT and adjacent property owners is not permitted. CONTRACTOR shall not cause any disruptions to site operations on Parcel A without OWNER's prior approval.

F. CONTRACTOR shall submit a Schedule of Operations to the OWNER for approval prior to any construction operations. OWNER shall be informed of any changes in the Schedule to allow ample time for the OWNER to notify affected parties. Updated progress reports shall be submitted to the OWNER at the end of each week.

G. The OWNER, ENGINEER, and CONTRACTOR shall attend a pre-construction meeting to be held at the site.

H. The CONTRACTOR shall complete separate pre-final and final inspection for each project component to the satisfaction of the OWNER, prior to closing out the component phase.

I. Prior to the scheduling of any pre-final inspection, all comments must be satisfied, and the CONTRACTOR shall submit a signed and sealed statement certifying that all materials, equipment and installation under this work comply with the Plans and Specification approved by the ENGINEER, and with the Oregon Building Laws and other applicable codes and regulations.

J. Within 5 days after pre-final inspection the CONTRACTOR shall submit a report to the OWNER indicating the status of each punch list item.

K. The CONTRACTOR shall not request a final inspection until all punch list items from the pre-final inspection have been resolved.

L. The OWNER shall not occupy areas or use equipment installed under this Contract, until a final inspection is held jointly with the CONTRACTOR, OWNER, and the ENGINEER.

K. Prior to any trenching, excavation, soil borings and/or underground exploration, the CONTRACTOR shall notify all Utilities Agencies having jurisdiction within Oregon.

M. One copy of all Testing Laboratory Reports shall be sent to the OWNER's office. All Reports shall be accompanied by a signed cover letter from the CONTRACTOR stating that the result of the Test has been accepted as satisfactory.

N. Hold all meetings with appropriate parties as scheduled and as needed to resolve issues in a timely manner so as not to impede the progress of the Scope of Work. Meetings shall include the following:

- Pre-mobilization meeting.
- Weekly construction progress meetings.
- Pre-final, punch list, final closeout meetings and inspections.
- Other meetings as necessary or as requested by OWNER, ENGINEER, or CONTRACTOR.

O. ENGINEER will produce and distribute meeting minutes from the previous week's meeting and the agenda for the each weeks meeting at least 24 hours before the scheduled weekly meeting. CONTRACTOR shall contact ENGINEER in advance, to insert items in the meeting agenda. ENGINEER shall also conduct the weekly progress meeting.

P. The ENGINEER will compile minutes of each additional meeting, and will furnish copies to the CONTRACTOR and OWNER.

1.9 APPLICABLE CODES

A. Building Laws and Ordinances:

Work in connection with any portion of this contract shall comply with latest revisions of the current Oregon codes and ordinances for the location.

B. Permits:

1. CONTRACTOR shall obtain and pay for all permits that may be required by law at the location, including filling, construction, transportation and disposal, confined space entry if it is necessary, or others.

2. CONTRACTOR shall obtain and review all Clackamas County Building and Electrical Code requirements and shall determine what permits for this work are required based on CONTRACTOR's final equipment layout for the remediation systems. The CONTRACTOR shall provide this information to the OWNER in writing.

3. All permits required to be displayed shall immediately be provided to the ENGINEER upon issuance and displayed in CONTRACTOR's on-site facilities.

4. The CONTRACTOR shall be responsible for all permit violations from any cause in connection with the project.

1.10 WORKMANSHIP

A. Installation:

1. All equipment shall be installed by skilled labor in accordance with manufacturer's instructions.

2. Any construction or site feature to be left in place that is weakened or damaged by the CONTRACTOR shall be restored by the CONTRACTOR to the condition that existed prior to such damage at no expense to the OWNER.

3. Construction or site features to be replaced after installation work shall be replaced with construction of equal strength and design.

4. All field work should proceed only after any utility that is shown on contract documents or otherwise identified through CONTRACTOR's utility locate is clearly marked in the field. Then work is to proceed with controlled excavation (with hand digging to expose known utilities) until the area has been opened sufficiently to utilize mass excavation.

B. Materials:

1. Use new, unused, and first quality materials, free of defects.

2. Use soil meeting the requirements of Section 02300 and 02301.
3. Use materials suitable for their application, and for the mechanical, structural, and electrical stresses to which they will be subjected.

4. Furnish as required for complete installation ready for operation, unless such material is specified to be furnished by OWNER.

C. Equipment:

1. Furnish in full conformance with the Plans and Specifications, and with necessary auxiliary items required for a complete workable system, in accordance with the intent of these Specifications.

2. Furnish so as to completely coordinate in physical arrangement with the Soil Cap.

1.11 SITE SAFETY REQUIREMENTS

A. All construction work exterior and interior shall be appropriately screened for the protection of the public and constructed with durable materials and finished in a manner attractive to the public.

1.12 CONTRACTOR USE OF SITE

A. Limit use of site and premises to allow on-going normal operation of the site and surrounding facilities.

B. Construction Operations: No limitations within the site boundaries except as noted in Section 01010 1.8.

C. Utility Outages and Shutdown are not allowed during the project.

1.13 LIMITATIONS

A. The CONTRACTOR and all Subcontractors must operate in accordance with the best practices of the profession. The CONTRACTOR shall provide all material, labor, equipment, tools, supplies, transportation, supervision, and all other services and facilities necessary to complete the project.

B. Unauthorized releases of hazardous substances by the CONTRACTOR or their Subcontractors, either during the on-site work or in the transport of hazardous materials or waste to or from the Site, will be remediated at the CONTRACTOR's expense.

C. Any damage to on-site or off-site roadways during the transportation of materials to or from the site shall be repaired by the CONTRACTOR at no expense to the OWNER.

D. CONTRACTOR shall limit operations to: 7 a.m. to 7 p.m., Monday through Saturday, or as approved by OWNER.

1.14 TESTING AND LABORATORY SERVICES

A. Soil density testing will be provided by the ENGINEER.

B. All other testing will be provided by the CONTRACTOR, as described in Section 01400.

1.15 QUALITY CONTROL

A. The CONTRACTOR is responsible for the overall quality of all work and the work performed by Subcontractors working under CONTRACTOR. The quality of any part of the work performed shall be not less than that specified by this Specification. If the ENGINEER determines that the quality of the work does not conform to the applicable specification, the ENGINEER will notify the OWNER and CONTRACTOR in writing of those areas of non compliance and the CONTRACTOR shall correct the deficiencies immediately and advise ENGINEER and OWNER in writing of the corrective action taken. Failure of the CONTRACTOR to comply with these requirements may be the cause for termination for default.

1.16 PROJECT RECORD DOCUMENTS

A. As specified in Section 01700.

PART 2 MATERIALS

Not Used

PART 3 EXECUTION

3.1 CONTRACTOR'S DUTIES:

A. Except as specifically noted, provide and pay for:
   1. Labor, materials, and equipment.
   2. Construction equipment and machinery.
   3. Temporary on-site services sufficient for CONTRACTOR's personnel and Subcontractors, ENGINEER and OWNER (e.g. water and sanitary).
   4. All other facilities and services necessary for proper execution and completion of Work.

B. Pay legally required sales, consumer and use taxes.

C. Conform with the requirements of all permits.

D. Secure and pay for, as necessary for proper execution and completion of the Work, applicable permits and licenses.

E. Give required notices.

F. Comply with codes, ordinances, rules, regulations, orders, and other legal requirements of public authorities which bear on performance of the Work.

G. Promptly submit written notice to ENGINEER and OWNER of any observed discrepancies in Specifications and quantities, or variance of Contract Documents from legal requirements.

H. If any subcontractor or person employed by the CONTRACTOR shall appear to the OWNER to be incompetent or to act in a disorderly or improper manner, they shall be discharged immediately on the request of the OWNER, and such person shall not again be employed on this project.

3.2 MAINTENANCE OF UTILITY SERVICE

A The CONTRACTOR is hereby advised that sewer lines, water lines, gas lines and underground power and telephone lines, and/or other utilities may exist in the area. The CONTRACTOR shall, prior to beginning the work, check with the utility companies for location of their facilities. All severed utilities shall be repaired immediately at CONTRACTOR's expense.

B. No extra payment will be allowed for the removal, replacement, repair, or possible increased cost caused by inadvertent or planned interception and breaking of underground utilities or other obstructions which may exist.

3.3 LOCATION OF UTILITIES

A. Any data shown on the Plans, or imparted to the CONTRACTOR by any representatives of the ENGINEER, relative to the locations, dimensions, type or character of the pipes, conduits, and other structures in or about the site are solely for the convenience of the CONTRACTOR. The OWNER and ENGINEER assume no responsibility for the accuracy or completeness of such data.

B. The CONTRACTOR shall assume full responsibility and shall make no claim against the OWNER or ENGINEER for any damage to any pipes, conduits, or other structures or for any inconvenience or added cost of performing the work which may be attributed in any degree to inaccuracy of information furnished or shown on the Plans relative to the location of such structures, or for failure to furnish or show on the Plans any such information.

3.4 PRE-MOBILIZATION MEETING

A. Attend the pre-mobilization meeting prior to the start of the Work to clarify construction contract administration procedures and address potential problems. The pre-mobilization meeting will be scheduled within approximately 7 days following the Notice of Award, and at least 5 days prior to CONTRACTOR's mobilization to the site. The pre-mobilization meeting will not be held until the pre-mobilization submittals have been made by CONTRACTOR.

B. Attendance is requested by authorized representatives of the following:

1. ENGINEER
2. CONTRACTOR
3. OWNER
4. ODOT
5. Others as Necessary

C. Minimum Agenda for Pre-Mobilization Meeting:

1. Discuss all aspects of the Project Management Plan.
2. Discuss the project schedule.
3. Discuss the distribution of Contract Documents.
4. Discuss the procedures for processing of field decisions and change orders.
5. Discuss safety and first aid, security, quality control, housekeeping, public relations and related matters.
6. Discuss the restrictions on use of premises by CONTRACTOR
7. Discuss emergency procedures while on site.
8. Discuss the procedures for testing.
9. Discuss maintaining record documents.
10. Discuss the general layout of the site.
11. Discuss wetlands and soil cap construction.
12. Discuss the equipment layout of the remediation systems.
13. Discuss the electrical design requirements of the remediation systems.
14. Discuss coordination requirements between GCW and Soil Cap project tasks.
15. Discuss the presentation of submittals.
16. Discuss payment application requirements.

3.5 CONSTRUCTION PROGRESS MEETINGS

A. Attend weekly meetings, pre-task conferences, and other meetings as necessary, throughout the progress of the Work.

B. CONTRACTOR shall designate the same person or persons to attend the progress meetings, when practicable, throughout the progress of the Work. Designate only persons with authority to commit the CONTRACTOR to revisions, modifications and solutions agreed upon in the meetings.

C. Update the progress schedule on a weekly basis and distribute copies to attendees.

D. Minimum agenda for routine progress meetings:

1. Review, revise as necessary, and approve minutes of previous meetings.
2. Review progress of the Work since last meeting and in general.
3. Identify problems which impede planned progress.
4. Develop corrective measures and procedures to address problems and schedule compliance.
5. Review the updated progress schedule and discuss schedule for material/waste transport to/from the site.
6. Effect of any proposed changes on progress schedule and coordination.
7. Summarize contacts with agencies regarding permits or clearance.
8. Plan progress during succeeding work period.
9. Special coordination requirements if necessary.
10. Maintenance of quality and work standards.
11. CONTRACTOR to submit copies of previous week's Sign-In/Out Logs, Weekly Progress Schedules, and written summaries of all contacts with agencies regarding permits or clearances.
12. Discuss other business relating to the Work.

3.6 TRADE UNION JURISDICTIONS

A. If union labor is utilized, CONTRACTOR shall maintain, and require subcontractors to maintain, complete current information on jurisdictional matters, regulations, actions and pending actions, as applicable to the work. CONTRACTOR shall discuss new developments at appropriate project meetings at the earliest feasible dates, and record information of relevance along with the action agreed upon.

B. The manner in which contract documents have been organized and subdivided is not intended to be an indication of jurisdictional or trade union agreements. Assign and subcontract the work, and employ tradesmen and laborers in a manner which will not unduly risk jurisdictional disputes of a kind which could result in conflicts, delays, claims and losses in the performance of the work.

END OF SECTION

SECTION 01011

REFERENCE STANDARDS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Quality assurance.

B. Codes, Rules, Regulations and Reference Standards.

1.2 RELATED SECTIONS

A. Section 01010 - Summary Description of Work

B. Section 01300 - Submittals

1.3 QUALITY ASSURANCE

A. For Products or workmanship specified by association, trade, or other consensus standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Conform to reference standard by date of issue current on date of Contract Documents.

C. Obtain copies of standards when required by the Contract Documents.

D. Maintain copies at project site during submittals, planning, and progress of the specific work, until Acceptance by OWNER, as defined in Section 11201 3.7.

E. Should specified reference standards conflict with Contract Documents, request clarification from the OWNER before proceeding.

F. The contractual relationship, duties, and responsibilities of the parties in Contract and those of the ENGINEER shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.4 CODES, RULES, REGULATIONS AND REFERENCE STANDARDS

A. Standards, codes, regulations and/or specifications cited in this Specification are requirements that must be met or exceeded for the successful performance of this project.

B. For products or workmanship specified by association, trade, or federal standards, the CONTRACTOR must comply with the requirements of the current standard, except when more rigid requirements are specified or are required by applicable code.

C. Should specified reference standards conflict with the Contract Documents, the CONTRACTOR must request clarification from ENGINEER before proceeding.

D. Perform work in accordance with applicable requirements of governing codes, rules, and regulations, including the following minimum standards, whether statutory or not:

1. BUILDING OFFICIALS AND CODE ADMINISTRATORS INTERNATIONAL, INC. (BOCA)

2. OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA)
   - 29 CFR 1926.652 Safety and Health Regulations for Construction
3. UNITED STATES ENVIRONMENTAL PROTECTION AGENCY (EPA)
4. STATE OF OREGON BUILDING CODES
5. UNIFORM PLUMBING CODE (UPC)
6. NATIONAL ELECTRIC CODE (NEC)
7. NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)
8. NATIONAL ELECTRIC CONTRACTORS ASSOCIATION (NECA)
9. NATIONAL ELECTRIC SAFETY CODE (NESC)
10. AMERICAN SOCIETY FOR TESTING AND MATERIAL (ASTM)
11. AMERICAN WATER WORKS ASSOCIATION (AWWA)
12. AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)
13. FEDERAL SPECIFICATIONS (FS)
14. AMERICAN CONCRETE INSTITUTE (ACI)
15. UNIFORM BUILDING CODE (UBC)
16. INTERNATIONAL MASONRY INDUSTRY ALL-WEATHER COUNCIL (IMIAC)
17. AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)
18. AMERICAN WELDING SOCIETY (AWS)
19. ALUMINUM ASSOCIATION STANDARD ANODIC FINISH (AASAF)
20. STEEL STRUCTURES PAINTING COUNCIL (SSPC)
21. NATIONAL ELECTRICAL MANUFACTURER'S ASSOCIATION (NEMA)
22. THE HYDRAULIC INSTITUTE
23. AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)
24. UNDERWRITERS LABORATORY (UL)
25. OREGON DEPARTMENT OF ENVIRONMENTAL QUALITY
26. OREGON WATER RESOURCES DEPARTMENT

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01170

HEALTH AND SAFETY

PART 1 GENERAL

1.1 DESCRIPTION OF WORK:

The work includes the requirements for health and safety provisions necessary for all work at the site on this project. Specifically, as specified in Section 11201, the work at the site entails the system installation, shakedown and startup of a treatment system for treating TCE, PCE, and VC impacted groundwater. Additionally, low level contaminated surface soils are present at the site.

1.2 SUBMITTALS

A. Prior to the start of any work, the CONTRACTOR shall provide a site-specific Health and Safety Plan which complies with 29 CFR Parts 1910 and 1926, and meets all the requirements of other local, state and federal laws, rules and regulations. The Health and Safety Plan shall address all requirements for health and safety for general construction, chemically-impacted groundwater, and chemically-impacted soils, including but not be limited to:

1. Summary description of work to be performed and anticipated physical and/or chemical hazards associated with the work.
2. Map of the site illustrating the location of the anticipated hazards and areas of control for those hazards.
3. Hazardous material inventory and Material Safety Data Sheets (MSDSs) for all chemicals which will be brought on site.
4. Signage appropriate to warn site personnel and visitors of anticipated site hazards.
5. Site Security and Control.
6. Engineering controls/equipment to be used to protect against anticipated hazards.
7. Personal protective equipment and clothing including, but not limited to, head, foot, skin, eye, and respiratory protection.
8. Procedures which will be used for:
    a. Fall Protection.
    b. Lockout/Tagout.
    c. Hot Work.
9. Exposure monitoring to be used to evaluate actual hazards compared with anticipated conditions.
10. Site housekeeping procedures and personal hygiene practices.
11. Personnel and equipment decontamination plan.
12. Administrative controls.
13. Emergency plan including locations of and route to nearest hospital.
14. Medical surveillance program for site personnel before, during, and after completion of site work.
    a. Doctor's written opinion that workers used for impacted soil excavation are medically qualified to wear a respirator.
15. Recordkeeping including:
    a. Documentation of 40-hour HAZWOPER training and other appropriate employee training.
    b. Respirator fit testing.
    c. Blood testing documentation for workers prior to start of work.

16. Name and qualification of person preparing the Health and Safety Plan and person designated to implement and enforce the plan.
17. Signatory page for site personnel to acknowledge receipt, understanding, and agreement to comply with the plan.

B. The CONTRACTOR can submit this site-specific Health and Safety Plan as one comprehensive document or can submit this plan as separate documents which relate to general health and safety and specifically to the subcontracted elements of the work.

C. ENGINEER and OWNER's review of the CONTRACTOR's site-specific Health and Safety Plan and the CONTRACTOR's work performance does not constitute approval of the adequacy of the CONTRACTOR's safety supervisor, the site-specific Health and Safety Plan, the CONTRACTOR's safety program or any safety measures taken in, on, or near the construction site. These Specifications dictate end results, and do not dictate methods used to reach those results. The safety of the methods used to perform the work are the responsibility of CONTRACTOR.

D. CONTRACTOR may reference, or otherwise use as a resource, the OWNER's Health and Safety Plan. In doing so, CONTRACTOR retains full responsibility for conformance with these Specifications and all health and safety regulations as they apply to CONTRACTOR and CONTRACTOR's subcontract personnel. CONTRACTOR shall make no claim against the OWNER or ENGINEER for any damages or injuries resulting from CONTRACTOR's use, as described above, of OWNER's Health and Safety Plan, Specifications, or Plans.

1.3 REFERENCES

The following references have the effect of being part of these specifications, insofar as they pertain to the work on this project:

A. Code of Federal Regulations (CFR)

1.	29 CFR Part 1910	Occupational Safety and Health Administration Occupational Safety and Health Standards
2.	29 CFR Part 1926	Occupational Safety and Health Administration Occupational Safety and Health Standards
3.	40 CFR 261	Identification and Listing of Hazardous Waste
4.	40 CFR 262	Standards Applicable to Generators of Hazardous Waste
5.	40 CFR 263	Standards Applicable to Transporters of Hazardous Waste

B. National Institute of Occupational Safety and Health (NIOSH)

1.	NIOSH 1985	Occupational Safety and Health Guidance Manual For Hazardous Waste Site Activities, October 1985

C. National Fire Protection Association (NFPA)

1.	NFPA 30	Flammable and Combustible Liquid Code

PART 2 PRODUCTS

2.1 PRODUCTS SPECIFIED FOR HEALTH AND SAFETY

A. Provide the equipment and supplies necessary to support the Work as described in the site-specific Health and Safety Plan. Equipment and supplies include but are not limited to:
   1. Chemicals to be used on site including cleaning degreasers, and/or welding/cutting supplies.
   2. Hazardous materials inventory and MSDSs for the chemicals brought on site.
   3. Fencing and barriers.
   4. Warning signs and labels.
   5. Equipment to support hot work.
   6. Fire extinguishers.
   7. Personal protective equipment (hard hats, foot gear, skin, eye, and respiratory protection.
   8. First aid equipment.
   9. Release prevention equipment.
   10. Field documentation logs/supplies.
   11. Decontamination equipment and supplies.

PART 3 EXECUTION

3.1 SPECIFIC SAFETY PROVISIONS

A. CONTRACTOR shall comply with local, state, and federal health and safety rules, regulations, and ordinances, the various construction permits, and other sections of the Contract Documents. Such compliance shall include, but is not specifically limited to: any and all protective devices, equipment and clothing; guards; restraints; locks; latches; switches; and other safety provisions that may be required by state and federal safety regulations. The CONTRACTOR shall determine the site-specific requirements for safety provisions and shall cause inspections and reports by the appropriate safety authorities to be conducted to ensure compliance with the intent of the regulations.

B. CONTRACTOR shall inform employees and subcontractors and their employees of the potential danger in working with soils and groundwater impacted with PCBs, PAHs, TCE, PCE, and VC.

C. CONTRACTOR shall comply with 29 CFR Parts 1910 and 1926 and NIOSH 1985 during excavation activities.

D. All on-site work shall be considered hazardous.

E. All employees involved in hazardous site work shall have current certification in Health and Safety at Hazardous Waste Sites (OSHA 29 CFR 1910).

F. Workers shall wear the appropriate personal protective equipment as required by site conditions. At a minimum, the site workers shall wear safety boots, eye protection, and a hard hat. Other protection shall be worn as specified in the CONTRACTOR's Health and Safety Plan.

G. All workers shall review and understand the CONTRACTOR's site-specific Health and Safety Plan and shall sign the document certifying that they have read it.

H. CONTRACTOR shall perform whatever work is necessary for safety and be solely and completely responsible for conditions of the job site, including safety of all persons (including employees of the ENGINEER, OWNER and CONTRACTOR) and property during the Contract period. This requirement applies continuously and is not limited to normal working hours.

I. Accidents causing death, injuries, or damage must be reported immediately to ENGINEER in person or by telephone or messenger, and to regulatory agencies as required by law. In addition, promptly report in writing to ENGINEER all accidents whatsoever arising out of, or in connection with, the performance of the work whether on, or adjacent to, the site, giving full details and statements of witnesses. If a claim is made by anyone against the CONTRACTOR

or any subcontractor on account of any accident, the CONTRACTOR shall promptly report the facts in writing within 24 hours after occurrence, to OWNER, giving full details of the claim.

J. If OWNER notifies CONTRACTOR that practices are in violation of permits, pertinent and applicable regulations, or that site conditions threaten property, human health or the environment, all work activity in the affected area(s) will cease until corrective actions have been taken. Any cost resulting from such a stop work order issued by OWNER shall be borne by CONTRACTOR and will not be considered as a basis for an increase in the contract amount.

3.2 SITE SAFETY AND HEALTH OFFICER

A. The CONTRACTOR shall provide a person designated as the Site Safety and Health Officer, who is thoroughly trained in first aid and the use of all necessary safety equipment. The person, or his/her authorized designee, must be present at all times while work is being performed and conduct testing, as necessary. The Site Safety and Health Officer may perform other duties while onsite.

B. The Site Safety and Health Officer shall be empowered with the delegated authority to order any CONTRACTOR or CONTRACTOR's subcontract personnel on the project site to follow the safety rules. Failure to observe these rules is sufficient cause for removal of the person or worker(s) from this project.

C. The Site Safety and Health Officer is responsible for determining the extent to which any safety equipment must be utilized, depending on conditions encountered at the Site.

END OF SECTION

SECTION 01300

SUBMITTALS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Submittals procedures.

B. Construction Schedule

C. Project Management Plan.

D. Health And Safety Plan.

E. Construction Erosion and Sediment Control Plan.

F. Contingency Plan.

G. Transportation Plan.

H. Soil Test Data.

I. Vendor Specification Submittal.

J. Proposed products list.

K. Product data.

L. Shop drawings.

M. Samples.

N. Design data.

O. Test reports.

P. Certificates.

Q. Manufacturer's instruction.

R. Manufacturer's field reports.

S. Erection drawings.

T. Project record documents.

U. Operation and Maintenance Manuals.

1.2 RELATED SECTIONS

A. General requirements of the Contract documents which affect the work of this section.

B. Section 01400 – Quality Control

C. Division 2 – Site Work

D. Division 3 – Concrete

D. Division 11 – Water Treatment Systems

F. Division 15 – Mechanical

G. Division 16 – Electrical Requirements.

1.3 REFERENCES

A. AGC (Associated General Contractors of America) publication "The Use of CPM (Critical Path Method) in Construction - A Manual for General Contractors and the Construction Industry".

1.4 SUBMITTAL PROCEDURES

A. CONTRACTOR shall maintain a record of each submittal which is made to the ENGINEER or OWNER, and shall accompany each submittal with a submittal form, numbered sequentially and dated. Revised submittals shall be marked with the original number and sequential alphabetic suffix. Faxed submittals or copies of illegible faxes will not be accepted as final.

B. Submittals shall be made in triplicate, with one copy being unbound to allow OWNER to make additional copies. One of the three copies will be returned to CONTRACTOR after OWNER's review, suitably notated to show the review results.

C. Identify Project, CONTRACTOR, Subcontractor or supplier; pertinent drawing and detail number, and Specification section number, as appropriate.

D. Apply CONTRACTOR's stamp, signed or initial certifying that review, approval, verification of Products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with the requirements of the work and Contract Documents.

E. Schedule submittals to expedite the Project, and deliver to ENGINEER and OWNER. Coordinate submission of related items.

F. For each submittal for review, allow five (5) business days excluding delivery time to and from the CONTRACTOR, for ENGINEER's and OWNER's review.

G. Identify variations from Contract Documents and Product or system limitations.

H. Provide 2 spaces on the front of the submittal document for CONTRACTOR, and OWNER review stamps.

I. When revised for resubmission, identify all changes made since previous submission.

J. Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report any inability to comply with requirements.

K. During the project, if CONTRACTOR wishes to substantially revise and resubmit a plan for the completion of work, the CONTRACTOR shall revise and resubmit all affected work plans. Minor revisions will require a simple addendum to the existing documents. In any event, the revised documents require the same OWNER approval as did the original document.

1.5 CONSTRUCTION SCHEDULES

A. The project schedule will be a bar chart (Gantt chart) showing the planned calendar dates during which work on each task will be performed and task precedence. The project schedule level of detail will, at a minimum, be consistent with that of the ENGINEER's project schedule developed during design.

B. The initial schedule shall be submitted within one (1) week after Notice to Proceed, as described in Section 01010.1.6.B.

C. During construction Progress Schedules shall be submitted as follows:

1. Indicate submittal dates required for shop drawings, product data, samples, and product delivery dates.

2. Progress Schedules shall summarize work completed since the previous update.

3. Progress Schedules shall identify upcoming work items and deliveries.

4. Progress Schedules shall be submitted to the ENGINEER and OWNER weekly.

1.6 PROJECT MANAGEMENT PLAN

A. The Project Management Plan shall include the following, at a minimum:

1. CONTRACTOR's project organization chart showing CONTRACTOR's supervisory personnel, subcontractor supervisory personnel, OWNER's and ENGINEER's contact persons.

2. Designated CONTRACTOR Safety Officer.

3. Designated CONTRACTOR representative authorized to negotiate Change Orders.

4. Business phone, home phone, and pager or cellular numbers for all the above persons.

5. CONTRACTOR shall prepare a detailed project site layout drawing(s) showing how CONTRACTOR and lower-tier subcontractors will use the site during the course of the Work. At a minimum, the layout drawing shall show material lay-down areas, project office location, the route of any temporary utility connections, site entry and exit points for vehicles, CONTRACTOR vehicle and equipment parking, employee parking, decontamination facilities, and fire extinguisher locations.

6. Detailed instructions to the soil cap borrow site excavation crew requiring them to be

observant for signs of potentially contaminated soil or buried waste or debris. If such is observed, the crew shall immediately stop excavation in that area and notify the appropriate CONTRACTOR representative, who will notify the OWNER within 12 hours. At that time, the CONTRACTOR shall provide to the OWNER a proposed remedial action plan.

B. The Project Management Plan shall be submitted within one (1) week after Notice to Proceed.

1.7 HEALTH AND SAFETY PLAN

A. CONTRACTOR's Site-Specific Health & Safety Plan (see Section 01170), (for OWNER's and ENGINEER's review only). Copies of workers' current certifications for working in hazardous environments shall be included for appropriate personnel. Health and Safety Plan shall be submitted prior to mobilization to the site.

B. The Health & Safety Plan shall be submitted within one (1) week after Notice to Proceed.

1.8 CONSTRUCTION EROSION AND SEDIMENT CONTROL PLAN

A. CONTRACTOR shall prepare an Erosion and Sediment Control Plan in accordance with the provisions contained in Section 02370.

B. The Erosion and Sediment Control Plan shall be submitted within one (1) week after Notice to Proceed.

1.9 CONTINGENCY PLAN

A. CONTRACTOR shall prepare a contingency plan for emergencies including releases to the environment, fire accident, or any other event that may require modification or abridgement of any work area. The plan shall include specific procedure for mitigation, maintenance or repair. Note that nothing in this Specification should impede safe exiting or providing of adequate medical attention in the event of emergency.

B. The Contingency Plan shall be submitted within one (1) week after Notice to Proceed.

1.10 TRANSPORTATION PLAN

A. CONTRACTOR shall prepare a transportation plan describing the routes over which material will be delivered to the site.

B. The Transportation Plan shall be prepared in accordance with the provisions required in Section 01500 1.12.

1.11 VENDOR SPECIFICATION SUBMITTAL

A. The Vendor Specification Submittal shall be composed of the Power Distribution and System Control Design and the Final Equipment Layout.

B. Power Distribution and System Control Design

1. CONTRACTOR shall prepare a complete electrical design package showing all applicable information required to obtain all electrical permits. The electrical design information shall be stamped by a Professional Electrical Engineer registered in the State of Oregon.

2. CONTRACTOR shall also submit a single line diagram, control panel wiring diagram, and control logic diagram for approval to ENGINEER.

C. Final Equipment Layout

1. CONTRACTOR shall prepare a final equipment layout for each equipment enclosure, showing the approximate location of each major piece of equipment (including the control panel), as well as the standard power outlet. This layout should also include a list of components that will be included in the enclosure, and shall indicate if any components for co-located systems have been combined.

D. The Vendor Specification Submittal shall be submitted within three (3) weeks after Notice to Proceed.

1.12 PROPOSED PRODUCTS LIST

A. Within five (5) days after date of Notice to Proceed, submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.

B. For products specified only by reference standards, give manufacturer, trade name, model or catalog designation, and reference standards.

1.13 PRODUCT DATA

A. Product Data For Review:

1. Submitted to OWNER and ENGINEER for review for the limited purpose of checking for conformance with information given and the design concept expressed in the contract documents.

2. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article above.

B. Product Data for Information:

1. Submitted for OWNER's and ENGINEER's knowledge.

C. Product Data for Project Close-out:

1. Submitted for OWNER's benefit during and after project completion.

D. Submit the number of copies which the CONTRACTOR requires, plus two copies which will be retained by OWNER and ENGINEER.

E. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturer's standard data to provide information specific to this Project.

F. Indicate product utility and electrical characteristics, utility connection requirements, and location of utility outlets for service and functional equipment and appliances.

G. After review, distribute in accordance with the Submittal Procedures article above.

1.14 SHOP DRAWINGS

A. Shop Drawings for Review: CONTRACTOR Furnished Drawings.

B. Shop Drawing for Information: Submitted for OWNER's and ENGINEER's knowledge.

C. Shop Drawings for Project Close-out: Submitted for OWNER's benefit during and after project completion.

D. Indicate special utility and electrical characteristics, utility connection requirements, and location of utility outlets for service of functional equipment and appliances.

E. Submit the number of reproductions which CONTRACTOR requires, plus two copies which will be retained by OWNER and ENGINEER.

1.15 SAMPLES

A. Samples for Review:

1. Submitted to OWNER and ENGINEER for review for the limited purpose of checking for conformance with information given and the design concept expressed in the contract documents.

2. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article above.

B. Samples for Testing

1. Submitted to appointed Independent Testing Laboratory (ITL) as specified in individual section.

C. Samples for Information:

1. Submitted for OWNER and ENGINEER's knowledge.

D. Submit samples to illustrate functional and aesthetic characteristics of the Product. Coordinate sample submittals for interfacing work.

E. Include identification on each sample, with full Project information.

F. Submit samples in duplicate or in the number of samples specified in individual Specification sections, to be retained by ENGINEER or OWNER.

G. Samples will not be used for testing purposes unless specifically stated in the Specification section.

1.16 DESIGN DATA

A. Submit for OWNER and ENGINEER's knowledge, and for OWNER's approval as specified.

B. Submit for information for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents.

1.17 TEST REPORTS

A. Submit for OWNER and ENGINEER's knowledge.

B. Submit test reports for information for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents.

1.18 CERTIFICATES

A. Certify that material or Product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

B. Certificates may be recent or previous test results on material or Product endorsed by the Manufacturer, but must also be acceptable to OWNER.

1.19 MANUFACTURER'S INSTRUCTION

A. When specified in individual Specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, to OWNER in quantities for Product Data.

B. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

C. Refer to Section 01400 - Quality Control, Manufacturer's Field Services.

1.20 MANUFACTURER'S FIELD REPORTS

A. Submit reports for OWNER's and ENGINEER's knowledge.

B. Submit report in duplicate within 30 days of observation to OWNER and ENGINEER for information.

C. Submit for information for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents.

1.21 ERECTION DRAWINGS

A. Submit drawings for OWNER's and ENGINEER's knowledge.

B. Submit for information for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents.

C. Data indicating inappropriate or unacceptable work may be subject to action by the ENGINEER or OWNER.

1.22 PROJECT RECORD DOCUMENTS

A. Submit project record documents specified in individual sections for OWNER and ENGINEER's knowledge.

1.23 RECORD DRAWINGS

A. One Complete Set Blue Line Prints Provided:

1. Keep separate and clean.

2. Reserve for complete picture of work actually installed.

3. Serve as work progress report sheets.

4. Notations made neat and legible.

6. Available all times at job site.

B. Record Layout Actual Routing

C. Completion of Work and Record:

1. Upon completion of the installation of the treatment systems CONTRACTOR shall produce three (3) sets of As-Built markup drawings. These drawings shall be signed by CONTRACTOR, dated and delivered to ENGINEER.

1.24 OPERATION AND MAINTENANCE MANUALS

A. Provide operating and maintenance manuals for all treatment equipment installed, including a schedule of recommended service as detailed in Section 11201.3.9.G. Three (3) copies of each manual are required.

B. Operation and maintenance manuals shall be submitted within 30-days after system acceptance.

PART 2 PRODUCTS

Not Used.

PART 3EXECUTION

Not Used.

END OF SECTION

SECTION 01400

QUALITY CONTROL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Quality assurance - control of installation.

B. Tolerances

C. Inspecting and testing laboratory services.

D. Manufacturers' field services and reports.

1.2 RELATED SECTIONS

A. General requirements of the Contract documents which affect the work of this section.

B. Section 01010, 01300

C. Division 2 - Site Work

D. Division 3 - Concrete

E. Division 11- Water Treatment Systems

F. Division 15 - Mechanical

G. Division 16 - Electrical Requirements.

1.3 QUALITY ASSURANCE - CONTROL OF INSTALLATION

A. Monitor and assure quality control of suppliers, manufacturers, Products, services, site conditions, and workmanship, to produce work of specified quality.

B. Comply with manufacturers' instructions, including each step in sequence.

C. Should manufacturers' instructions conflict with Contract Documents, request clarification from ENGINEER before proceeding. If clarification results in potential cost or schedule impacts, CONTRACTOR must obtain OWNER’s approval to proceed.

D. Comply with specified standards as minimum quality for the work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Perform work by persons qualified to produce workmanship of specified quality.

F. Secure products in place with positive anchorage and support devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.

1.4 TOLERANCES

A. Monitor tolerance control of installed products to produce acceptable Work. Do not permit tolerances to accumulate.

B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from ENGINEER before proceeding. If clarification results in potential cost or schedule impacts, CONTRACTOR must obtain OWNER's approval to proceed.

C. Adjust products to appropriate dimensions; position and confirm dimensions before securing Products in place.

1.5 INSPECTING AND TESTING LABORATORY SERVICES

A. CONTRACTOR shall be responsible for all soil and concrete laboratory testing services required in these Specifications.

B. OWNER shall be responsible for all random testing that is desired.

C. ENGINEER shall perform soil density testing of Soil Cap to determine conformance with Specifications.

D. ENGINEER shall perform all air and water sampling required to assess treatment system performance during acceptance testing and during operation. Any water or vapor sampling required prior to acceptance testing shall be the responsibility of the CONTRACTOR at no cost to the OWNER.

E. Re-testing required because of non-conformance to specified requirements shall be performed on instructions by the OWNER. Payment for re-testing will be charged to the CONTRACTOR by deducting inspection or testing charges from the Contract Sum/Price.

F. CONTRACTOR shall start-up, test, adjust, and balance all systems and demonstrate that they are fully operational and free of defects. CONTRACTOR shall demonstrate that all level, shut-off, and alarms are properly adjusted and functioning. CONTRACTOR shall demonstrate that all meters and instruments are properly functioning and that all equipment and piping is free from dirt and debris.

1.6 MANUFACTURERS' FIELD SERVICES AND REPORTS

A. When specified in individual Specification sections, require material or Product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, and test, adjust and balance of equipment as applicable, and to initiate instructions when necessary.

B. Submit qualifications of observer to OWNER and ENGINEER 30 days in advance of required observations. Observer subject to approval of OWNER.

C. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

D. Submit report within 15 days of observation to OWNER and ENGINEER for information.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01500

TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Construction Facilities:
   1. Field offices and sheds.
   2. Vehicular access.
   3. Parking.

B. Temporary Utilities:
   1. Temporary electricity.
   2. Temporary lighting.
   3. Telephone service.
   4. Facsimile service.
   5. Temporary water service.
   6. Temporary sanitary facilities.
   7. Progress cleaning and waste removal.

C. Temporary Controls:
   1. Fencing.
   2. Security.
   3. Stormwater Control.
   4. Dust control.
   5. Erosion and sediment control.
   6. Pollution Control.
   7. Traffic regulation.

D. Removal of Temporary Facilities and Controls.

E. Project Identification.

1.2 FIELD OFFICES AND SHEDS

A. CONTRACTOR shall establish a field office on site for use by the CONTRACTOR during the project. CONTRACTOR shall establish a second furnished office trailer for the exclusive use of ENGINEER and OWNER. The OWNER/ENGINEER trailer shall be a minimum 30′ length, with two or more offices. CONTRACTOR shall coordinate the electricity and telephone connections to both field office trailers.

B. CONTRACTOR is completely responsible for the security of his tools, equipment and vehicles during the project. CONTRACTOR shall provide temporary storage sheds, if necessary, at CONTRACTOR's expense.

C. Locate field office and sheds a safe distance from work areas to ensure safety during excavation and demolition.

D. Field office shall be a portable or mobile building, capable of being removed from site within 24 hours notice.

1. Construction: Structurally sound, secure, weather tight enclosures for office and storage spaces. Maintain during progress of Work. Remove at completion of Work.
2. Exterior Materials: Exterior to be in good repair and finished in a color acceptable to OWNER.
3. Fire Extinguishers: Appropriate type fire extinguisher at each office.

E. Preparation: Fill and grade sites for temporary structures sloped for drainage away from buildings.

F. Removal: At completion of Work remove buildings, foundations, utility services, and debris. Restore areas.

1.3 VEHICULAR ACCESS

A. Utilize existing access drives from public thoroughfares to serve the project area.

B. Extend and relocate vehicular access as Work requires.

C. Provide and maintain ready access to fire hydrants and utilities safely out of high traffic flow areas.

D. Provide means of removing mud from vehicle wheels , wheel wells, and undercarriage before entering streets.

1.4 PARKING

A. CONTRACTOR shall show parking areas for vehicles and equipment on the Site Layout drawing in the Project Work Plan, subject to approval by OWNER.

1. CONTRACTOR shall monitor all CONTRACTOR on-site vehicles for leaks.

2. Spillage or leakage of fuel or lubricants and/or fluids of any kind from equipment shall not be allowed. Repair or immediately remove from site all equipment showing evidence of leakage. Immediate clean-up by the CONTRACTOR at CONTRACTOR's cost will be required.

3. Do not clean or wash vehicles on site, except for removing dirt from wheels, wheel wells, or undercarriage prior to exiting site.

4. No maintenance of equipment or vehicles is allowed on site, except for routine lubrication and fueling.

5. Overnight storage of vehicles and equipment shall be in designated areas.

6. CONTRACTOR shall protect paved and unpaved areas from contamination. Absorbent materials shall be used to contain any oil or fuel spill. Contaminated absorbent material shall be disposed of in accordance with applicable state and federal regulations.

1.5 TEMPORARY ELECTRICITY

A. CONTRACTOR shall provide temporary electric power as necessary to supply the required project offices, and to power CONTRACTOR's portable lights and power tools.

1. Connection to existing temporary service shall be coordinated with Portland General Electric's Service Coordinators (503-736-5450).

B. When CONTRACTOR establishes new temporary electrical service, CONTRACTOR shall become liable for the costs therefore. Electrical power for the offices and appurtenances shall be paid for by the CONTRACTOR during the duration of the work.

1.6 TELEPHONE SERVICE/ RADIO COMMUNICATIONS

A. CONTRACTOR shall provide, maintain, and pay for telephone service to the field offices throughout the project.

B. CONTRACTOR shall provide, maintain, and pay for on-site communication radios and base station for CONTRACTOR crew use. One additional radio shall be provided, maintained, and paid for by the CONTRACTOR for ENGINEER's or OWNER's use.

1.7 FACSIMILE SERVICE

A. CONTRACTOR shall provide, maintain and pay for facsimile (FAX) service to the CONTRACTOR's field office throughout the project.

1.8 TEMPORARY WATER SERVICE

A. CONTRACTOR may provide a new source of water at his own cost.

B. CONTRACTOR shall ensure that potable water is available for drinking, washing and personal decontamination near the field offices.

1.9 TEMPORARY SANITARY FACILITIES

A. CONTRACTOR shall provide, pay for, and maintain required sanitary facilities and enclosures at time of project mobilization.

1.10 PROGRESS CLEANING AND WASTE REMOVAL

A. CONTRACTOR shall maintain areas free of waste materials, debris, and rubbish, except for designated storage areas. CONTRACTOR shall maintain the site in a clean and orderly condition, and shall clean and remove miscellaneous trash at least weekly. Waste disposal shall be conducted in accordance with applicable state and federal regulations.

1.11 TRAFFIC REGULATION

A. CONTRACTOR's Site Layout in the Project Work Plan shall show all signs, signals and other traffic control devices to be utilized in the interior of the site, if any. CONTRACTOR's Transportation Plan shall show all signs, signals, flagmen and other traffic control devices (flares, cones, drums, barricades, lights, etc) proposed for use to control traffic in the streets around the site. The Transportation Plan shall specify that all truck access to the site will be

from the north along Industrial Avenue.

B. Flag Persons: Provide trained and equipped flag persons to regulate traffic when construction operations or traffic encroach on public traffic lanes.

C. Flares and Lights: Use flares and lights during hours of low visibility to delineate traffic lanes and to guide traffic.

D. Haul Routes: Consult with the authority having jurisdiction to determine public thoroughfares to be used for haul routes and site access. Truck site access shall be from the north, as stated in item A above.

1.12 SECURITY

A. In addition to the fence, CONTRACTOR shall maintain security of the site to prevent vandalism and theft of CONTRACTOR's, ENGINEER's, and OWNER's materials and equipment.

B. CONTRACTOR's security program shall be initiated at mobilization, and shall continue until project closeout work is complete. The security program shall include the following features, at a minimum.

1. Observation of entrance and exit gates when they are open.
2. Restrict entrance of persons and vehicles into the site.
3. Allow entrance only to authorized persons.
4. Maintain a sign-in/sign-out log of workers and visitors. Make log available to ENGINEER and OWNER on request.
5. Lock gates when site is unsupervised.

1.13 STORMWATER CONTROL

A. Protect the site from ponding or running water. Provide water barriers as required to protect the site from soil erosion as required in Section 02370.

1.14 DUST CONTROL

It is CONTRACTOR's responsibility to ensure that operations do not generate dust emissions greater than 3 mg/m^3 above background concentrations or 20% opacity.

A. Perform the Work using methods that minimize raising dust from demolition operations.

B. Use water spray as necessary to suppress dust from stockpiling, unloading, placing, compacting, and any other site activities potentially creating excess dust. Use water spray and/or calcium chloride solutions on vehicle traffic areas to suppress road dust as needed.

1.15 EROSION AND SEDIMENT CONTROL

A. CONTRACTOR shall control stormwater, erosion and sediment movement in accordance with the Erosion and Sediment Control Plan, developed per Section 02370.

1.16 POLLUTION CONTROL

A. Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by site operations.

B. Comply with pollution and environmental control requirements of Federal, State, and local authorities.

C. Provide decontamination facilities to avoid "tracking" of pollutants off of the site or into non-impacted areas.

1.17 REMOVAL OF TEMPORARY FACILITIES AND CONTROLS

Prior to submitting the final Application for Payment, CONTRACTOR shall remove all temporary facilities and controls in accordance with the provisions contained in Section 02370.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01600

MATERIAL AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Transportation and handling.

B. Storage and protection.

C. Product options.

D. Substitutions.

1.2 RELATED SECTIONS

A. General requirements of the Contract documents which affect the work of this section.

B. Section 01400 - Quality Control

C. Division 2 - Site Work

D. Division 3 - Concrete

E. Division 11- Water Treatment Systems

F. Division 15 - Mechanical

G. Division 16 - Electrical Requirements.

1.3 PRODUCTS

A. Do not use materials and equipment removed from existing premises, except as specifically permitted by the Contract Documents.

B. Provide interchangeable components of the same manufacturer for components being replaced, as much as possible.

1.4 TRANSPORTATION AND HANDLING

A. Transport and handle Products in accordance with manufacturer's instructions.

B. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and Products are undamaged.

C. Provide equipment and personnel to handle Products by methods to prevent soiling, disfigurement, or damage.

1.5 STORAGE AND PROTECTION

A. Store and protect Products in accordance with manufacturers' instructions, with seals and labels intact and legible at OWNER's designated on-site location, where and when available.

B. Store sensitive products in weather-tight, climate controlled enclosures.

C. For exterior storage of fabricated Products, place on sloped supports, above ground.

D. Provide off-site storage and protection when site does not permit on-site storage or protection.

E. Cover Products subject to deterioration with impervious sheet covering. Provide ventilation to avoid condensation or potential degradation of product.

F. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

G. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

H. Arrange storage of Products to permit access for inspection. Periodically inspect to verify Products are undamaged and are maintained in acceptable condition.

1.6 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Any Product meeting those standards or description.

B. Products Specified by Naming One or More Manufacturers: Products of manufacturers named and meeting specifications, no options or substitutions allowed without OWNER's prior approval.

C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named in accordance with the following article.

1.7 SUBSTITUTIONS

A. Substitutions may be considered when a Product becomes unavailable through no fault of the CONTRACTOR.

B. Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents.

C. A request constitutes a representation that the CONTRACTOR:

1. Has investigated proposed Substitution and determined that it meets or exceeds the quality level of the specified Product and will provide an endorsed original letter from the manufacturer. This letter will be an affidavit guaranteeing that the product to be substituted equals or exceeds the quality and operational characteristics of the specified product, which is to be listed by name and product number.

2. Will provide the same warranty for the Substitution as for the specified product.

3. Will coordinate installation and make changes to other work which may be required for the work to be complete with no additional cost to OWNER.

4. Waives claims for additional costs or time extension which may subsequently become apparent.

5. Will reimburse OWNER and ENGINEER for review or redesign services associated with re-approval by authorities.

D. Substitutions will not be considered when they are indicated or implied on product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.

E. Substitution Submittal Procedure:

1. Submit three copies of request for Substitution for consideration. Limit each request to one proposed Substitution.

2. Submit shop drawings, product data, and certified test results attesting to the proposed Product equivalence. Burden of proof is on CONTRACTOR.

3. The OWNER will notify CONTRACTOR in writing of decision to accept or reject request.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01650

STARTING OF SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Starting systems.

B. Demonstration and instructions.

C. Testing, adjusting, and balancing.

1.2 RELATED SECTIONS

A. General requirements of the Contract documents which affect the work of this section.

B. Section 01400 - Quality Control

C. Division 2 - Site Work

D. Division 3 - Concrete

E. Division 11 - Water Treatment Systems

F. Division 15 - Mechanical

G. Division 16 - Electrical Requirements

1.3 STARTING SYSTEMS

A. Coordinate schedule for start-up of all equipment and systems.

B. Notify ENGINEER and OWNER via fax and email, five business days prior to start-up of each item.

C. Test operate each system individually. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, control sequence, or for other conditions which may cause damage. Confirm proper operation, check for vibrations, noises and other indications of malfunction or mis-adjustment. Switch system off. Systems to be test operated include all mechanical and electrical systems and their components provided and/or installed by CONTRACTOR.

D. Verify that tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

E. Verify that wiring and support components for equipment are complete and tested.

F. Execute start-up under supervision of applicable manufacturer's representative in accordance with manufacturers' instructions, when so specified.

G. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.

H. Demonstrate connections and pipe joints are tight and free from leaks.

I. Keep a record for each system tested. Record date of testing, note proper or unusual performance or conditions, note all instrument readings, record recommended adjustments, needed modifications or repairs, record date of modification or repair or other corrective measures. Upon successful test operation of system submit triplicate records (three copies) to OWNER for approval and signature. OWNER and ENGINEER to retain one copy, one copy for CONTRACTOR.

J. Upon successful testing of each system and sign-off by OWNER for each system. Position all switches and valves to their normal operating position. Start all systems.

1. Make all necessary adjustments.

2. Operate each sample port valve, demonstrate functional.

3. Demonstrate all controls and instruments are functional.

4. Record date of testing. Record all gauge and instrument readings, proper or unusual operations, recommended adjustments, modifications or repairs. Record the type and date adjustments, modifications or repairs were made, record the date of successful testing and provide three copies of the testing record to the OWNER for approval and signature. One copy to be retained by the ENGINEER, one copy for OWNER, and one copy for CONTRACTOR.

1.4 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate operation and maintenance of Products to OWNER's and ENGINEER's personnel one week prior to date of final inspection.

B. Demonstrate Project equipment operation by a qualified representative who is designated by the manufacturer, (provide copy of representative’s certification), as being fully qualified to operate, adjust and test performance of said equipment.

C. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with OWNER's and ENGINEER's personnel in detail to explain all aspects of operation and maintenance.

D. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at agreed time, at equipment location.

E. Provide Operation and Maintenance documentation for any modifications made to the system during the system warranty period (the first year of operation).

1.5 TESTING, ADJUSTING AND BALANCING

Not Used.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01700

CONTRACT CLOSEOUT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Closeout procedures.

B. Final cleaning.

C. Adjusting.

D. Project record documents.

E. Operation and maintenance data.

F. Warranties.

G. Spare parts and maintenance materials.

1.2 RELATED SECTIONS

A. General requirements of the Contract documents which affect the work of this section.

B. Section 01400 - Quality Control

C. Division 2 - Site Work

D. Division 3 - Concrete

E. Division 11- Water Treatment Systems

F. Division 15 - Mechanical

G. Division 16 - Electrical Requirements.

1.3 CLOSEOUT PROCEDURES

A. Submit written certification that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for OWNER’s and ENGINEER's review.

B. Provide submittals to OWNER and ENGINEER that are required by governing or other authorities.

C. Submit Operation and Maintenance Manual.

1.4 FINAL CLEANING

A. Execute final cleaning prior to final project assessment. Remove all waste materials, rubbish, tools, equipment, machinery and all surplus materials, leaving the entire project area clean and suitable for use.

B. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances.

C. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.

D. Clean filters of operating equipment.

E. Clean debris from drainage systems.

F. Clean site of mud, spoils, and construction debris. Remove and dispose of properly.

G. Remove waste and surplus materials, rubbish, and construction facilities from the site.

H. Restore lawn and landscape on ODOT property to pre-construction conditions.

1.5 ADJUSTING

A. Final adjust operating Products and equipment to ensure smooth and unhindered operation.

1.6 PROJECT RECORD DOCUMENTS

A. Maintain on site, one set of the following record documents; record actual revisions to the Work:

1. Drawings.
2. Specifications.
3. Addenda.
4. Change Orders and other modifications to the Contract.
5. Reviewed Shop Drawings, Product Data, and Samples.
6. Manufacturer's instruction for assembly, installation, and adjusting.

B. Ensure entries are complete and accurate, enabling future reference by OWNER.

C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress.

E. As-Built Drawings: Prepare record drawings on electronic CAD files provided by OWNER, utilizing AutoCAD Versions 2000 or 2002, and mark each item to record actual construction including:

1. Survey horizontal and vertical locations of underground utilities and appurtenances, referenced to NGVD 29.

2. Survey horizontal and vertical locations for Top of Casing, and Center of Cover for each new monitoring well and GCW.

3. Survey alignment and depth of new underground piping and utilities.

4. Survey horizontal and vertical locations of each corner of the equipment enclosures.

5. Survey horizontal and vertical locations of wetlands to a level necessary for as-built documentation.

6. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.

7. Field changes of dimension and detail.

8. Details not on original Contract drawings.

F. Submit documents to OWNER and ENGINEER with request for final inspection, under provisions of Section 01300.

1.7 OPERATION AND MAINTENANCE DATA

A. Submit data bound in 8-1/2 x 11 inch (216 x 279 mm) text pages, three D side ring binders with durable plastic covers along with scanned copy on CD ROM utilizing Microsoft Office or Adobe Acrobat.

B. Prepare binder cover and CD ROM with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS", title of project, and subject matter of binder when multiple binders are required.

C. Internally subdivide the binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.

D. Contents: Prepare a Table of Contents for each volume, with each product or system description identified, typed on 24 pound white paper, in three parts as follows:

1. Part 1: Directory, listing names, addresses, and telephone numbers of OWNER, ENGINEER, CONTRACTOR, Subcontractors, and major equipment suppliers.

2. Part 2: Operation and maintenance instructions, arranged by system. For each category, identify names, addresses, and telephone numbers of subcontractors and suppliers. Identify the following:
   a. Significant design criteria.
   b. List of equipment.
   c. Parts list for each component.
   d. Operating instructions.
   e. Maintenance instructions for equipment and systems.
   f. Maintenance instructions for special finishes, including recommended cleaning methods and materials and special precautions identifying detrimental agents.
   g. Summary schedule of maintenance for all equipment grouped by maintenance interval (i.e. weekly, 3 month, 1 year, etc.).

3. Part 3: Project documents and certificates, including the following:
   a. Shop drawings and product data.
   b. Certificates.
   c. Photocopies of warranties and bonds.
   d. Project Record Documents and specifications complete with CONTRACTOR notes and CONTRACTOR signature.

E. Submit 1 draft copy of completed volumes 10 days prior to pre-final inspection. This copy will be reviewed and returned after pre-final inspection, with OWNER and ENGINEER comments. Revise content of all document sets as required prior to final submission.

F. Submit three sets of revised final volumes hard and electronic, within 5 days after pre-final inspection and prior to final application for payment.

1.8 WARRANTIES

A. Provide notarized copies along with three scanned copies on CD ROM utilizing Microsoft Office or Adobe Acrobat.

B. Execute and assemble transferable warranty documents from Subcontractors, suppliers, and manufacturers.

C. Provide Table of Contents and assemble in three D side ring binder with durable plastic cover.

D. Submit prior to final Application for Payment.

E. For items of work delayed beyond date of substantial completion, provide updated submittal within ten days after acceptance, listing date of acceptance as start of warranty period.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

DIVISION 2

SITE WORK

SECTION 02000

MOBILIZATION

PART 1 GENERAL

1.1

A. Provide all labor, materials and equipment to ready the Site for the timely start and efficient completion of work. The CONTRACTOR shall perform all site visits as necessary to obtain the necessary information to secure all permits and to mobilize and de-mobilize all personnel and equipment in an efficient manner and be an informed participant in the pre-construction meeting.

1.2 PERMITS, LICENSE AND FEES

A. Prepare the necessary paperwork and obtain all necessary permits to insure compliance with all applicable federal, state and local regulations. Permits shall include, but not limited to, permits for transporting hazardous materials as applicable and building permits.

1.3 COORDINATION

A. Coordinate with the regulatory agencies for all necessary inspections during the project duration.

B. Coordinate completion and clean up of work in preparation for OWNER's pre-final and final inspection.

C. Coordinate work with other CONTRACTORS, Subcontractors, and utility companies.

PART 2 MATERIALS

Not Used

PART 3 EXECUTION

A. CONTRACTOR shall mobilize to the site within one (1) week of Notice to Proceed.

END OF SECTION

SECTION 02100

SITE PREPARATION

PART 1 GENERAL

1.1 WORK INCLUDED

A. This section describes the general requirements for site preparation around existing wells and above-ground structures.

1.2 RELATED SECTIONS

A. Section 01600 - Material and Equipment

B. Section 02010 - Underground Utilities

C. Section 02230 - Site Clearing

D. Section 02300 - Earthwork and Grading

E. Section 02670 - Well Modification

F. Section 02671 - Well Installation, Development and Sampling

G. Section 03300 - Cast-in-Place Concrete

1.3 REGULATORY REQUIREMENTS

A. Conform to applicable code for disposal of debris.

B. Coordinate clearing work with OWNER and utility companies.

1.4 SCHEDULE

A. Schedule site preparation before drilling or construction. Such schedule shall be reflected in the CONTRACTOR's construction project schedule.

1.5 OWNERSHIP

A. All material removed during site preparation, except material specified and indicated for salvage by the OWNER, is the property of the CONTRACTOR to be disposed of in accordance with Section 3.3.

1.6 SITE

A. The CONTRACTOR shall coordinate with OWNER to minimize disruptions to operations (on Parcel A).

1.7 SAFETY REQUIREMENT

A. Avoid damaging any existing pipes or conduit except those requiring alteration or removal. CONTRACTOR shall make sure that such pipes and lines are disconnected prior to alteration or removal. The CONTRACTOR shall pay for the cost of repairing damage to any underground utilities.

1.8 WELL PROTECTION

A. CONTRACTOR shall flag all monitoring well locations with an 8 ft pole painted with fluorescent paint and flagging.

B. CONTRACTOR shall be held responsible for any damage to monitoring wells during construction. CONTRACTOR shall repair or replace any monitoring well that is damaged by CONTRACTOR or Subcontractors at no cost to OWNER.

C. If well replacement of groundwater wells (piezometers, monitoring wells, or groundwater circulating wells) is required due to damage, then CONTRACTOR shall abandon the damaged well compliance with OAR 690-220, and install a new well as directed by OWNER. Abandonment and installation due to CONTRACTOR or Subcontractor damage shall be at no cost to OWNER.

PART 2 PRODUCTS

2.1 EQUIPMENT

A. Types of equipment to be used for site preparation shall be selected and furnished by the CONTRACTOR.

2.2 MATERIALS

A. CONTRACTOR shall inspect the site as to the nature, location, size, and extent of structures and obstructions to be removed, graded or preserved, as specified herein.

PART 3 EXECUTION

3.1 PROTECTION OF PROPERTY

A. CONTRACTOR shall protect all property outside construction work limits from construction activities.

3.2 PREPARATION

A. Verify that existing features designated to remain are tagged or identified.

B. Locate, identify, and protect utilities from damage.

C. Protect benchmarks and existing structures from damage or displacement.

3.3 DISPOSAL

A. CONTRACTOR shall chip and windrow vegetative debris on site as indicated on the plans or as approved by OWNER.

B. Windrows shall not exceed 4 ft in height.

C. All other debris shall be removed and disposed in accordance with all applicable laws and regulations.

3.4 EROSION CONTROL

A. Provide for the diversion and control of surface water and all runoff from the active work areas of the site during construction according to the provisions contained in Section 02370.

A. While working on ODOT property, CONTRACTOR shall prevent surface runoff from becoming mixed with soil and subsequently discharging to the storm sewers.

END OF SECTION

SECTION 02230

SITE CLEARING

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes removal of select areas of trees, shrubs, and other plant life; and disconnection and termination of utilities, if encountered, at the property line.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 PRELIMINARY EXAMINATION

A. CONTRACTOR shall carefully examine the site and available documents to obtain first-hand knowledge of existing conditions affecting this work. No extra compensation will be allowed for the discovery of conditions that could have been determined by a careful examination of the site and available documents.

B. Prior to commencing work, CONTRACTOR, ENGINEER, and OWNER shall tour the Project Site together to examine the site and note any item that will affect progress or completion.

3.2 DISCONNECTION AND TERMINATION OF UTILITIES

A. Live utilities are not expected to be found on the site although abandoned utilities may be encountered. If utilities are found the CONTRACTOR shall disconnect all utilities at the property line (within five feet), or at another nearby point as approved by OWNER. In cases where the utility entrance to the property includes an underground vault, the termination shall be made in the vault, and the vault shall be left in place and not removed under other paragraphs of this Section. CONTRACTOR shall coordinate with the utility companies and Clackamas County to establish approved methods and approved schedules for disconnecting the utilities, and to establish the physical method by which utilities will be terminated awaiting possible reconnection.

B. CONTRACTOR shall determine the best schedule for disconnecting and terminating the utilities, to facilitate CONTRACTOR's temporary need for utilities.

C. Disconnecting and terminating utilities shall be accomplished in a neat, clean manner that meets pertinent code requirements, does not interfere with subsequent site work, and can become permanent.

D. CONTRACTOR shall erect markers to allow easy future location of the terminated utilities. Markers shall be concrete monuments, flush to the ground surface, and with stamped letters in a metal, cast-in top-plate (or similarly permanent markers). Each concrete monument shall have a steel fence post driven into the ground next to the marker.

E. CONTRACTOR shall provide "as-built" drawings of all utility terminations showing the type of termination made, and the physical location and appearance.

3.3 REMOVAL OF VEGETATION

A. All vegetation on Parcel B shall be removed prior to vegetation. All other vegetation to remain to the extent practicable.

B. Vegetation removed on the ODOT property shall be repaired or replaced upon completion of work in that area.

C. Removed vegetation will be chipped and windrowed or stockpiled in locations shown in the Plans.

END OF SECTION

SECTION 02300

EARTHWORK AND GRADING

PART 1 GENERAL

1.1 WORK INCLUDED

This work includes placing 2 feet of compacted fill within the subject property boundary. The work also includes surface grading for control of stormwater, and to provide a relatively uniform site condition.

1.2 RELATED SECTIONS

A. Section 02100 - Site Preparation

B. Section 02310 - Well Modifications

C. Section 02370 - Erosion and Sediment Control

1.3 SCHEDULE OF REFERENCES

ASTM - American Society for Testing and Materials

1.4 DEFINITIONS

A. Compaction: Measured as a percent of Standard Proctor (ASTM D698) density.

B. Finish Grading: Operations required for grading and smoothing areas that are undeveloped.

C. Fill: Approved fill material obtained from a source determined by the CONTRACTOR.

PART 2 PRODUCTS

2.1 FILL MATERIAL

A. Fill material shall be approved by OWNER prior to delivery to site, per the requirements of Part 3.1 - Fill Acceptance.

B. Approved fill material must be soils free of debris and be capable of supporting grass growth.

C. Acceptable organic content range: 2 to 10% (as determined by ASTM D2974)

D. Fill soils must meet the following grain size distribution:

	% Passing	
US Sieve No.	Minimum	Maximum
2 in.	100	- -
¾ in.	95	100
200	30	40

2.2 ROAD GRAVEL

A. Gravel for road surfaces shall be 1½" minus crushed rock or as approved by OWNER.

2.3 GEOTEXTILE FABRIC

A. Geotextile fabric shall be an 8-oz., non-woven geotextile for roadway separation.

B. Fabric shall allow drainage to pass through.

C. Geotextile fabric product sheet shall be submitted to OWNER for approval prior to installation.

2.4 SEED MIX

A. Seed mix shall be a native grass erosion control mix as specified in Section 02900.2.1.A and 02914.

PART 3 EXECUTION

3.1 FILL ACCEPTANCE

A. The CONTRACTOR shall provide a written, notarized certification from the landowner of each proposed off-site soil borrow source stating its location and that to the best of the landowner's knowledge and belief there has never been contamination of the borrow source site with hazardous or toxic materials. The certification shall be furnished in the bid package, and shall include detailed historical information on past borrow source site use.

B. The imported cap soil shall meet the definition of clean fill as provided in OAR 340-093-0030(13). Under DEQ procedures (OAR 340-093-0080(2)) and as allowed in this project, soil not meeting the definition of clean fill can be used only if it does not exceed the U.S. EPA Region IX's residential soil preliminary remediation goals, the U.S. EPA Region IX's soil screening level migration to groundwater, or the screening level values for ecological receptors, whichever is lower. In addition for TPH contamination, the Level 1 standards presented in OAR 340-122-335 must be met. The ecological screening level values are available on the DEQ website at www.deq.state.or.us/wmc/documents/eco-2slv.pdf.

C. Soil materials derived from the excavation of underground petroleum storage tanks or other contaminated site remediation projects shall not be used as fill on this project.

D. The ENGINEER may perform random sampling of soils that are placed on the site to verify the quality of the soils and that they meet the minimum specification at the direction and expense of the OWNER. Should any failing tests be reported, the CONTRACTOR shall be required to perform additional testing to determine the extents of the failing soil. The test program shall be approved by the OWNER. The CONTRACTOR shall then remove and dispose of the failing soil in accordance with applicable transportation and disposal regulations, and replace it with soil meeting the Specifications. The CONTRACTOR shall additionally test the replacement soil to verify that it meets the Specifications. All additional work resulting from a failing sample shall be performed by the CONTRACTOR at no additional expense to the OWNER.

E. Provide physical analysis results, from testing of each borrow site, showing conformance with 2.1.C and .D requirements. Test results shall be submitted with bid package.

3.2 FILLING

A. Install Work in accordance with all applicable Federal, State, and Local standards.

B. Fill areas to contours and elevations as shown on Plans or as directed by the OWNER with approved fill material. Soil Cap shall be a minimum two feet thick.

C. Place fill material in continuous layers and compact to 90% of maximum dry density as measured by the Standard Proctor method (ASTM D698).

D. Maintain fill within 2% of optimum moisture content to attain required density.

E. Make grade changes gradual. Blend slope into level areas.

F. Slope fill at extents of the site no steeper than 2H:1V to match existing grades at site boundaries.

3.3 FILL PLACEMENT

A. Lift Thickness: Place soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 6 inches in loose depth for material compacted by hand-operated tampers.

B. Moisture Control: Before compaction, moisten or aerate each layer as necessary to provide near-optimum moisture content (ASTM D698) and to facilitate required compaction. Compact each layer to the required percentage of maximum dry density. Maintain uniform moisture content within 2 percent of the optimum moisture content as determined by ASTM D698, to allow compaction to the specified density.

C. Compaction:

1. Utilize appropriate compaction equipment.

2. Compact all soils to 90 percent of the maximum dry density as determined by the Standard Proctor test (ASTM D698).

3.4 ROAD GRAVEL PLACEMENT

A. Compact gravel material to 95% as measured by Modified Proctor method (ASTM 1557).

B. Road surface shall be at same elevation as final cap surface.

C. Make grade changes gradual. Blend slope into level areas.

D. Slope road at extents of the site no steeper than 10H:1V to match existing grades at soil cap boundaries.

3.5 ROUGH GRADING

A. Identify required lines, levels, contours, and datum.

B. Stake and flag locations of known utilities.

C. Locate, identify, and protect from damage capped utilities indicated to remain.

D. Protect above and below grade utilities indicated to remain.

E. Protect benchmarks, survey control points, monitoring wells, fences, and paving from excavating equipment and vehicular traffic.

3.6 SUB-BASE FILL

A. Soil excavated from the Wetlands Mitigation Area shall be filled onsite in the areas indicated on the plans.

B. Sub-base fill shall meeting the placement and compaction requirements specified in 3.2 and 3.3.

3.7 FIELD QUALITY CONTROL

A. Secure the ENGINEER's approval of subgrades and fill layers before subsequent construction is performed.

B. The ENGINEER will perform field density and moisture testing.

C. If, in the ENGINEER's opinion, as based on the test reports, the backfill is below specified density, provide additional compaction and testing at no additional cost to the OWNER.

SECTION 02301

WETLANDS CONSTRUCTION EARTHWORK & GRADING

PART 1 GENERAL

1.1 WORK INCLUDED

A. This section specifies earthwork, which consists of soil excavation, filling, and grading, and placement on site of excess soil. Any variation to these Specifications due to unforeseen conditions encountered on the site, weather changes, etc. shall be approved by the OWNER.

PART 2PRODUCTS

2.1 WETLAND SOIL

A. Wetlands soil (topsoil) shall be free of all lumber, mortar, concrete, rubbish, debris, contaminated soil and any other non-naturally occurring material larger than 2 inches in diameter or harmful to plant life in areas to be seeded and planted.

2.2 FILL MATERIAL

A. Fill material shall be the same material specified in Section 02300 2.1 and 3.1.

PART 3EXECUTION

3.1. HABITAT MATERIAL IDENTIFICATION

A. Prior to site disturbance, the ENGINEER shall identify tree material (limbs and trunks), rocks, or other habitat material to be salvaged and stored. These materials shall be used as habitat in the wetlands construction to be placed as shown on the Plans or as directed by OWNER.

3.2 VEGETATION REMOVAL

A. The OWNER shall direct vegetation removal activities on the site and may approve variations to this Specification. Vegetation shall be removed along the eastern ditch to 50-feet up and downstream of the Wetlands Mitigation Area.

B. Vegetation removal shall be accomplished by removing topsoil from the areas shown on the Plans to a depth of 12-inch minimum and disposing off the mitigation site and under the cap.

C. Patches of reed canarygrass shall be removed by digging out the plant with its roots to at least an 18 inches in depth, and disposed off the project site. Reed canarygrass shall be mowed or dug out by its roots as soon as any regrowth is observed.

D. For noxious types of non-native blackberry (*Rubus discolor and Rubus lacinatus*), plants shall be removed by digging out the plant with its roots to at least an 18-inch depth, and disposed off the project site. All parts of non-native blackberries including canes, roots, and leaves shall be removed and disposed off the project site.

3.3 EXCAVATION

A CONTRACTOR shall excavate soils in the wetlands area to the appropriate depth, so that the final grade shown on the Plans is achieved after the placement of 18-inches of fill material followed by 6-inches of wetlands soil.

B. Soil excavated from the Wetlands Mitigation Area shall be place elsewhere on the project site in locations identified in the Plans. All soil placed on site shall be in 8-inch lifts and compacted to 90% compaction, per Section 02300.

3.4 PLACEMENT OF WETLANDS SOIL

A. Before preparing subsoil, CONTRACTOR shall remove all unnecessary equipment, debris, construction materials, temporary fences or gates, and all other CONTRACTOR properties from the area where the topsoil is to be spread.

B. Following placement of the 18-inches of fill material to a depth of 6 inches below the final wetland grade, CONTRACTOR shall rip the fill compacted by vehicles or equipment to a 12- to 18-inch depth, as practicable.

C. Wetlands soil shall be uniformly distributed to a minimum compacted thickness of 6 inches in areas shown on the Plans. The soil shall be compacted enough to ensure good contact with the subsoil, but avoid excessive compaction as directed by OWNER. Wetlands soil shall not be spread during heavy rain events, or if wetland soil material is saturated.

D. Grading of the Wetlands Mitigation Area shall achieve the elevations of the specified control points shown on the Wetlands Grading Plan.

E. Grading between the Wetlands Mitigation Area and the rest of the Soil Cap shall be accomplished by the CONTRACTOR using slopes not to exceed 3H:1V.

F. Immediately before seeding, CONTRACTOR shall disc, harrow or use other means as necessary to achieve a clod size of 3 inches or less. The final pass with equipment shall be made parallel to the contours. The seed bed shall be rolled with a corrugated roller to provide a good germination medium. Surface preparation operations shall be conducted along the contours of the areas involved. On cut slopes, the CONTRACTOR shall form minor ridges and irregularities parallel to the contours to retard erosion and improve germination.

END OF SECTION

SECTION 02370

EROSION AND SEDIMENT CONTROL

PART 1 GENERAL

1.1 DESCRIPTION OF THE WORK

A. CONTRACTOR shall develop an Erosion and Sediment Control Plan (ESCP) to be implemented and maintained during the project. The plan shall provide for installation, operation and maintenance of erosion and sediment control Best Management Practices (BMPs) that may be necessary to prevent water pollution and to control, respond to, and provide disposition of eroded sediment and turbid water during the life of the contract.

B. Approval from the OWNER is required prior to installation of BMPs. The Work consists of installing BMPs as necessary or as might be directed by the OWNER, and removing any interim erosion and sediment control BMPs used during the Remedial Action, as well as all BMPs following projection completion.

C. This work shall apply to all areas associated with the Work including, but not limited to the following:

1. Work areas.

2. Equipment and material storage areas.

3. Staging areas.

4. Stockpiles.

D. During Remedial Action, CONTRACTOR is responsible for operating and maintaining the Erosion and Sediment Control system, including:

1. Properly inspect erosion and sediment control components as required; facilitate, participate in, and implement directed corrective actions resulting from inspections conducted by others, including regulatory agencies.

2. Adhere to the ESCP regarding operating procedures.

3. Maintain the system as required to keep it completely functional.

4. Cleanup and dispose of all contained sediment and turbid water.

E. Excavated soils are not to be stored on paved areas unless on Plastic Sheeting with containment berms.

1.2 ADMINISTRATIVE REQUIREMENTS

A. The provisions of this section shall apply to CONTRACTOR, subcontractors at all tiers, suppliers and all others who may have access to the work site by way of CONTRACTOR's activities.

B. The CONTRACTOR shall be solely responsible for any damages, fines, levies, or judgements incurred as a result of CONTRACTOR, subcontractor, or supplier negligence in complying with the requirements of this Section.

C. Any damages, fines, levies, or judgements incurred by the OWNER as a result of CONTRACTOR, subcontractor, or supplier negligence in complying with the requirements of this Section will be deducted from payment due to CONTRACTOR for the Work.

D. The CONTRACTOR shall be solely responsible for any schedule impacts from damages, fines, levies, judgements, or stop work orders incurred as a result of CONTRACTOR, subcontractor, or supplier negligence in complying with the requirements of this Section. The project schedule will not be changed to accommodate the time lost.

1.3 OWNER ACTIONS

A. If the CONTRACTOR is out of compliance with erosion and sediment control requirements, the OWNER may direct the CONTRACTOR to provide immediate temporary pollution control measures to minimize erosion and movement off-site of sediment and turbid stormwater runoff, at no expense to the OWNER.

B. The OWNER may increase or decrease the amount of erosion and sediment controls as determined by evaluation of project conditions.

C. In the event that areas adjacent to the work area are suffering degradation due to erosion, sediment deposit, water flows, or other causes, the OWNER may stop construction activities until the situation is rectified by CONTRACTOR.

PART 2 PRODUCTS

2.1 GEOTEXTILE SILT FENCE

A. Geotextile silt fence shall be installed at the locations shown on the ESCP.

B. Geotextile silt fence installation shall follow manufacturers recommendations.

C. Type I Geotextile:

1. Woven slit film polypropylene.

2. Individual slit films woven together to provide dimensional stability relative to each other.

3. Resistant to ultraviolet degradation and to biological and chemical environments normally found in soils.

4. Minimum Average Roll Values:

Property	Test Method	Units	Results
Grab Tensile Strength	ASTM D 4632	lbs	100 x 100
Grab Elongation	ASTM D 4632	percent	15 x 15
Puncture Strength	ASTM D 4833	lbs	58
Mullen Burst	ASTM D 3786	psi	265
Trapezoidal Tear	ASTM D 4533	lbs	50 x 50
Apparent Opening Size	ASTM D 4751	US Std. Sieve	20
Permittivity	ASTM D 4491	sec-1	0.2
Water Flow Rate	ASTM D 4491	gpm/ft^2	15
UV Resistance (percent retained at 500 hours)	ASTM D 4355	percent	90

D. Posts: 2 x 2 in x 24 to 48 in Pine or steel with fastening projections.

E. Mesh: Steel or plastic, 14-gauge minimum, with maximum mesh opening of 6 in.

F. Quality Control

1. Manufacturing Quality Control: Testing shall be performed at a laboratory accredited by GAI-LAP for tests required for the geotextile, at frequency exceeding ASTM D 4354, with following minimum acceptable testing frequency:

Property	Test Method	Test Frequency sq ft
Grab Tensile Strength	ASTM D 4632	100,000
Grab Elongation	ASTM D 4632	100,000
Trapezoidal Tear	ASTM D 4533	100,000
Mullen Burst	ASTM D 3786	100,000

G. Conformance Testing: Testing will be waived for ISO 9002-certified manufacturers.

PART 3 EXECUTION

3.1 GENERAL

A. In the event of conflict between these Specifications and pollution control laws, rules, or regulations of other Federal, state, or local agencies, the more restrictive laws, rules, or regulations shall apply.

B. No discharge of water shall be allowed that increases volume, velocity, or peak flow rate of receiving water background conditions.

3.2 EROSION AND SEDIMENT CONTROL PLAN REQUIREMENTS

A. Site Description and Drawings

1. Included shall be a written description or drawing of the construction site, including location of staging areas, material storage areas, and areas of ingress and egress for the site.

2. The drawings shall show locations of BMPs during each phase of construction as identified by the CONTRACTOR in the Project Schedule.

B. CONTRACTOR Erosion and Sediment Control Personnel

1. The CONTRACTOR shall designate one employee as the responsible representative in charge of erosion and sedimentation control.

2. Duties and responsibilities of the CONTRACTOR's representative shall include:

a. Inspect ESCP requirements including BMPs as required to ensure adequacy; facilitate, participate in, and take corrective actions resulting from inspections performed by outside agencies, ENGINEER, or OWNER.

C. Schedule

1. The CONTRACTOR's Project Schedule (Section 01010.1.6.B) shall include:

a. Schedules for accomplishment of temporary and permanent erosion control work, as are applicable for clearing and grubbing, and cap placement;

b. Estimated installation date of all temporary BMPs.

c. Estimated date of final site stabilization.

2. Erosion control work activities consistent with the ECSP shall be included in the Project Schedule.

D. BMP Installation

1. The ESCP shall include installation instructions and details for each BMP used during the life of the Project.

E. BMP Maintenance

1. BMPs shall be maintained for the life of the project or until removed as directed by the OWNER.

2. BMPs shall be maintained during all suspensions of work and all non-work periods.

3. BMPs shall be maintained and repaired as needed to assure continued performance of their intended function.

4. Sediments removed during BMP maintenance shall be placed away from natural and constructed stormwater conveyances.

F. BMP Inspection

1. At a minimum, inspect all erosion and sediment controls weekly and after any rain event 0.5 inch or greater in a 24-hour period.

2. Deficiencies identified during the inspection shall be corrected within 24 hours or as directed by the OWNER.

3. Note repairs or improvements needed, if any, and notify the OWNER to implement improvements.

4. Observe runoff leaving the site during storms, checking for turbid water.

5. Measure turbidity at upstream and downstream monitoring locations along each drainage course (east and west ditch). CONTRACTOR activities shall not cause greater than a 10% increase in turbidity.

6. Implement additional BMPs, if needed, to address site-specific erosion control.

7. Inspect streets surrounding site for dirt tracking.

8. Inspect for dust during dry periods.

G. Record Keeping

1. Reports summarizing the scope of inspections, the personnel conducting the inspection, the date(s) of the inspection, major observations relating to the effectiveness of the ESCP, and actions taken as a result of these inspections shall be prepared by CONTRACTOR and retained.

2. All inspection reports shall be kept on-site during the life of the project and available for review upon request of the ENGINEER or OWNER.

H. BMP Removal

1. Remove all BMPs after CONTRACTOR has demonstrated to ENGINEER that work area has been stabilized.

I. Emergency Response

The CONTRACTOR shall control and respond to turbid water discharges, sediment movement, and fugitive dust. At a minimum, the CONTRACTOR's employee responsible for, or first noticing, the discharges shall take appropriate immediate action to protect the work area, private property, and the environment (e.g., diking to prevent pollution of state waters). Appropriate action includes but is not limited to the following:

1. Hazard Assessment - Assess the source, extent, and quantity of the discharge.

2. Securement - If the discharge cannot be effectively controlled, then immediately notify the OWNER. If the discharge can be safely and effectively controlled, proceed immediately with action to protect the work area, private property, and the environment.

3. Containment and Elimination of Source - Contain the discharge with silt fence, pipes, sand bags or a soil berm downslope from the affected area. Eliminate the source of the discharge by pumping turbid water to a controlled area, building berms, piping clean water away from the area or other means necessary.

4. Cleanup - When containment is complete, chemically treat turbid water, remove sediment and stabilize on site, or use other methods to prevent future discharge.

5. Notification - Report all discharges immediately to the ENGINEER.

3.3 OTHER REQUIREMENTS FOR EROSION CONTROL DURING THE PROJECT

A. Construction Entrances and Exits

1. If mud or debris is tracked from the site it shall be cleaned up immediately.

2. Mud and debris shall be removed from pavement by sweeping and shoveling and transported to a controlled sediment disposal area.

3. Use of water to wash concrete or asphalt pavement shall be allowed only after sediment has been removed by sweeping and shoveling.

4. If the mud and debris are contaminated by fuels, grease, metals or other pollutants, they shall be segregated and stored in the soil storage area, at CONTRACTOR's expense, to be tested by ENGINEER.

END OF SECTION

SECTION 02670

WELL MODIFICATION

PART 1 GENERAL

1.1 WORK INCLUDES

A. Modification of existing monitoring wells and piezometers as indicated on Drawings G03.

B. All work is to be performed by a State of Oregon Licensed Monitoring Well Constructor.

1.2 RELATED SECTIONS

A. Section 01300 - Submittals

B. Section 02000 - Mobilization

C. Section 02100 - Site Preparation

D. Section 02300 - Earthwork and Grading

1. 3 REFERENCES

A. OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) – 29 CFR 1926 and 29 CFR 1910.

B. ASTM C387 – Concrete.

1.4 DEFINITIONS

A. Utility: Any buried pipe, duct, conduit, or cable.

1.5 SUBMITTALS

A. Submit manufacturer's product sheets for bentonite chips, bentonite pellets, and cement specified or equivalent to OWNER for approval 48 hrs before placement.

1.6 PROTECTION

A. Provide necessary materials to provide safety and ensure safe working conditions, and to protect public private property and permanent improvements from damage during construction.

B. Comply with the occupational safety, and health requirements of the State of Oregon and other appropriate agency requirements and standards.

PART 2 PRODUCTS

2.1 MATERIALS

A. Monitoring well cap (vented).

B. Bentonite-Cement Seal: Cement-bentonite mixture will consist of up to 5% by dry wt. Bentonite with water not exceeding 7 gallons per sack of cement (94 lbs). Cement used shall be ASTM Type I-II, commonly known as Portland cement.

C. Concrete: Commercially available, ready to use mix (Quickrete concrete mix) shall be used for concrete seal. For each bag of mix add the manufacturer's recommended amount of clean water. The mix shall exceed compressive strength requirements of ASTM C387 (i.e. 2500 and 4000 psi after 7 and 28 days, respectively).

D. Monitoring wells shall be surface completed with a flush mount well cover.

PART 3 EXECUTION

3.1 MODIFICATION OF EXISTING MONITORING WELLS AND PIEZOMETERS

A. Well modifications shall be performed by a State of Oregon Licensed Monitoring Well Constructor.

B. Prior to placement of the soil cap CONTRACTOR shall flag all existing wells on site with an 8 ft fluorescent painted pole or stake.

C. CONTRACTOR shall remove existing steel bollards.

D. CONTRACTOR shall hand compact soils within a 5 ft radius of the well, or compact using a hand operated vibratory plate compactor.

E. Following completion of the cap, CONTRACTOR shall cut the steel casing to final grade, and cut the PVC casing to 4-inches below final grade.

F. CONTRACTOR shall fill the annulus between the steel casing and PVC casing with cement grout, to within approximately 6 inches of the top of the PVC casing.

G. CONTRACTOR shall place a lockable expansion cap onto the top of each PVC casing.

H. CONTRACTOR shall weld a new flush-mounted monument to the top of the steel casing at each well location.

I. CONTRACTOR shall install one (1) 3 ft steel bollard at each on-site well location. Bollards shall be concrete filled, anchored in cement, and painted a safety yellow color.

J. CONTRACTOR shall be responsible for all damage to monitoring wells or piezometers during construction. CONTRACTOR shall make repairs to restore any well to its preexisting condition or replace (if unrepairable) any wells that are damaged during construction at no cost to OWNER.

3.2 INSPECTION

A. Allow ENGINEER and OWNER access for inspection at all times.

END OF SECTION

SECTION 02671

WELL INSTALLATION AND DEVELOPMENT

PART 1 GENERAL

1.1 WORK INCLUDES

A. Drilling and installation of monitoring wells as indicated on Drawing S01 and S03.

B. Drilling and installation of groundwater circulation wells (GCW). The GCWs will be installed as indicated on Drawing S01 and S03.

C. Development of monitoring wells and groundwater circulation wells.

1.2 RELATED SECTIONS

A. Section 01300 - Submittals

B. Section 02000 – Mobilization

C. Section 02010 - Underground Utilities

D. Section 02100 - Site Preparation

E. Section 01600 - Material and Equipment

F. Section 15051 – GCW System Piping and Equipment

1. 3 REFERENCES

A. ASTM D421 and ASTM D422 - Method for Sieve Analysis / Gradation Analysis of Fine and Coarse Aggregates.

B. OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) – 29 CFR 1926 and 29 CFR 1910.

C. ASTM C387 – Concrete.

1.4 DEFINITIONS

A. Utility: Any buried pipe, duct, conduit, or cable.

1.5 FIELD MEASUREMENTS

A. Verify that survey bench marks, control points, and intended elevations for the Work are as shown on drawings.

1.6 TESTS

A. CONTRACTOR will containerize soil cuttings in storage bins in a location approved by OWNER. Soil will be characterized by ENGINEER for disposal determination.

B. CONTRACTOR will containerize water produced by the drilling and purging operations in drums in a location approved by OWNER. Water will be characterized by ENGINEER for disposal determination.

C. The ENGINEER will provide personnel to monitor the drilling activities to classify the soil removed and perform analytical testing of the soil (as necessary). The CONTRACTOR will monitor the ambient air conditions in the vicinity of the drilling to confirm that the ambient air conditions comply with the CONTRACTOR's Health and Safety Plan. If ambient air conditions in the vicinity of the excavation require the use of Personal Protective Equipment (PPE) or upgrade of the existing PPE, the CONTRACTOR will immediately notify the ENGINEER. The CONTRACTOR shall provide all PPE for CONTRACTOR and subcontractor personnel at CONTRACTOR's expense.

1.7 SUBMITTALS

A. Submit 1 lb. sample of each of the sand packs specified or equivalent to the OWNER for approval along with sieve analysis results 48 hrs before placement.

B. Submit manufacturers product sheet for bentonite chips, bentonite pellets, and cement specified or equivalent to OWNER for approval 48 hrs before placement.

C. Submit manufacturers product sheets for monitoring well screens, GCW screens, and casings to OWNER for approval 48 hrs before placement.

1.8 PROTECTION

A. Provide necessary materials to shore and brace wells and borings to prevent slope failure, to prevent adjacent surface settlement, to provide safety and ensure safe working conditions, and to protect public private property and permanent improvements from damage during construction.

B. Comply with the occupational safety, and health requirements of the State of Oregon and other appropriate agency requirements and standards.

C. Cover or fence all open wells and borings at the end of each day.

PART 2 PRODUCTS

2.1 MATERIALS

A. Sand pack for 0.020 slot screen. Suggested vendors:
American Materials Corp. - Type Red Flint # 30 (approx. 10 to 12 mesh)
Badger Mining Corp. – Type T 1.0 – 1.4
Global Drilling Suppliers – Type Global # 7 (0.017 x 0.033 inches)

B. 2-inch PVC SCH40 0.020 slot screen. Suggested vendor: Johnson Screens

C. 2-inch PVC SCH40 casing. Suggested vendor: Johnson Screens

D. 10-inch PVC SCH40 casing. Suggested vendor: Johnson Screens

E. 10-inch diameter, 10 ft long, Johnson stainless steel screen, 0.020 slot

F. Monitoring well protective casing.

G. Monitoring well cap (vented).

H. Bentonite chips. Pure Gold Medium Chips, size ¼'' to 3/8'', bulk density 69.25lbs/ft^3, or equivalent. Use approximately 59 lb chips/linear ft for a 16-inch diameter hole.

I. Bentonite-Cement Seal. Cement-bentonite mixture will consist of up to 5% by dry wt. Bentonite with water not exceeding 7 gallons per sack of cement (94 lbs). Cement used shall be ASTM Type I-II, commonly known as Portland cement.

J. Concrete. Commercially available, ready to use mix (Quickrete concrete mix) shall be used for concrete seal. For each bag of mix add the manufacturer's recommended amount of clean water. The mix shall exceed compressive strength requirements of ASTM C387 (i.e. 2500 and 4000 psi after 7 and 28 days, respectively).

K. Casing centralizer.
1. For 2" PVC Monitoring Wells
2. For 10" PVC GCW
3. Space centralizers every 10 ft along the well casing.

L. The GCW well cover assembly shall be the subsurface vault for the in-situ air-stripping unit as shown in Drawing S02 and discussed in Section 11201. Three bollards shall be installed in a triangle pattern around the finished GCW to protect the well from vehicle damage.

M. Monitoring wells shall be surface completed with a flush mount well cover. A single bollard shall be installed next to each monitoring well.

PART 3 EXECUTION

3.1 PREPARATION

A. Identify required lines, levels, contours, and datum locations.

B. Protect bench marks, existing structures, paving, and on-site equipment and facilities from drilling equipment and vehicular traffic.

C. Maintain and protect above and below grade utilities which are to remain.

D. Set up a decontamination pad or area to clean augers and other drilling equipment.

3.2 DRILLING

A. Use equipment, tools, and machines to perform Work in accordance with the requirements covered by Specifications. CONTRACTOR shall maintain equipment, tool and machines in satisfactory working condition.

B. Drill cuttings will be placed in approved storage bins provided by CONTRACTOR, at CONTRACTOR's expense. Drill water and purge water will be stored in approved drums provided by CONTRACTOR at CONTRACTOR's expense.

C. Drill so that new and existing permanent improvements shall not be damaged or subjected to settlement or horizontal movement.

D. Restore disturbed areas to their original grade, profile, and finish, or in the manner specified for completion o the Work.

E. Coordinate in a timely manner with OWNER and maintain and leave open the boreholes/borings until OWNER observes and approves the placement of the materials.

F. Replace and rework any material that becomes unsuitable or unstable as the result of Work during inclement weather. Alternatively, remove such unsuitable or unstable material and replace with new material when directed by OWNER.

3.3 GCW INSTALLATION

A. The GCW will be installed as shown on the site drawings. See Drawing S01 for locations, and Drawing S03 for well construction details.

B. The GCW borehole will be 16-inches in inside diameter, and will be drilled using an air rotary or other appropriate drilling technique suitable for sub-surface conditions at the site, as approved by OWNER. Drill cuttings will be visually examined for changes in lithology and observations will be recorded on the boring log by the OWNER.

C. The GCW will be constructed of a 10-inch inside diameter PVC SCH40 casing which will be threaded to two screened sections. The well will be screened at the appropriate intervals as defined by Drawing S03. A 1-ft deep sump (10-inch inside diameter PVC SCH40) will be attached to the bottom of the lower screen.

D. The GCW screen sections will be 10-inch diameter, stainless steel, Johnson (or equivalent) continuous wire-wrap type with a screen-opening equivalent to 0.020 inches. Screen lengths are 10 ft at the intervals shown on Drawing S03. The screens section shall be threaded to match the PVC casing.

E. The annular space between the borehole and the well screen will be filled with clean silica sand (10-20 mesh). The filter pack will extend approximately 2 ft above and 2 ft below each end of both screens. The filter pack materials will be placed in the borehole using a tremie pipe.

F. Bentonite seal above the deep sand-pack will be at least 4-ft thick and will extend from the top of the deep sand pack to the bottom of the shallow sand pack. The bentonite seal above the shallow sand-pack will be 3-ft thick. Bentonite chips or pellets will be placed in the borehole

using a tremie pipe. The annular space from the bottom of the subsurface vault to the top of the upper bentonite seal will be filled with cement-bentonite grout mix at a ratio of 19:1 (i.e. 19 pounds of cement to 1 pound of bentonite). Well construction details are summarized on Drawings S03 for each type of well.

3.4 MONITORING WELL INSTALLATION

A. The monitoring wells will be installed as shown on the site drawings. See Drawing S01 for locations, and Drawing S03 for well construction details.

B. The monitoring well borehole will be 6-inches in inside diameter, and will be drilled using an air rotary or other appropriate drilling technique suitable for sub-surface conditions at the site, as approved by OWNER. Drill cuttings will be visually examined for changes in lithology and observations will be recorded on the boring log by the ENGINEER.

C. The monitoring well will be constructed of a 2-inch diameter PVC SCH40 casing which will be threaded to a screened section. The well will be screened at the bottom 5-feet or at the appropriate interval as directed by the ENGINEER.

D. The monitoring well screen sections will be 2-inch diameter PVC, with a screen-opening equivalent to 0.020 inches. Screen lengths are 5 ft at the interval shown on Drawing S03. The screens section shall be threaded to match the PVC casing.

E. The annular space between the borehole and the well screen will be filled with clean silica sand (10-20 mesh). The filter pack will extend approximately 2 ft above the screen section. The filter pack materials will be placed in the borehole using a tremie pipe.

F. The bentonite seal above the shallow sand-pack will extend from the top of the filter pack to 1-foot below ground surface. Bentonite chips or pellets will be placed in the borehole using a tremie pipe. The top 1-foot of annular space will be filled with cement-bentonite grout mix at a ratio of 19:1 (i.e. 19 pounds of cement to 1 pound of bentonite). Well construction details are summarized on Drawings S03 for each type of well.

3.5 WELL DEVELOPMENT

A. To ensure good hydraulic connection of the formation to the filter pack around the well screens, the GCWs and monitoring wells will be developed using a submersible pump, bailer or well-dedicated Waterra Inertial pumps. Each well will be pumped and periodically surged with a surge block. During well development, measurements of the water level, pH, EC (conductivity), turbidity, and temperature will be periodically recorded. Well development will continue until the water is free of sediment and the parameters stabilized to within ±10% of the previous readings. Development equipment will be provided by CONTRACTOR.

B. The CONTRACTOR shall containerize all well development water and any other water generated during drilling and well installation.

3.6 DECONTAMINATION AND CLEANING

A. Decontamination and cleaning procedures will be used during all field activities to minimize the

potential for cross-contamination. All portions of the drilling augers and auger bits will be steam cleaned prior to use at each well boring location at a central cleaning area located at the NWPC Parcel B area. All sampling tools, including the split spoon-samplers, will be cleaned with a non-phosphate soap solution, followed by a double rinse in tap water, and a final rinse with distilled water prior to use.

3.7 INSPECTION

A. Allow OWNER access for inspection at all times.

END OF SECTION

SECTION 02741

HOT-MIX ASPHALT PAVING

PART 1 GENERAL

1.1 WORK INCLUDED

A. This Section includes hot-mix asphalt paving, patching, and paving overlay.

1.2 PROJECT CONDITIONS

A. Environmental Limitations: Use locally available materials that exhibit a satisfactory record of previous installations. Shall meet or exceed the requirements of OR DOT standard specifications for roadways and structures. Do not apply asphalt materials if subgrade is wet or excessively damp.

PART2 PRODUCTS

2.1 AGGREGATES

A. Coarse Aggregate: ASTM D 692, sound; angular crushed stone, crushed gravel, or properly cured, crushed blast-furnace slag.

B. Fine Aggregate: Fine Aggregate-Sharp edge natural sand or sand prepared from stone, gravel complying with ASTM D 1073.

C. Mineral Filler: Rock or other inert material complying with ASTM D 242. Asphalt Cement-ASTM D 3381 for viscosity graded materials. ASTM D 946 for penetration graded material. Tack Coat-Emulsified asphalt ASTM D 977.

D. Hot-Mix Asphalt: Dense, hot-laid, hot-mix asphalt plant mixes approved by authorities having jurisdiction (designed according to procedures in AI MS-2, "Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types").

PART 3 EXECUTION

3.1 PATCHING

A. Hot-Mix Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.

B. Tack Coat: Apply uniformly to vertical surfaces abutting or projecting into new, hot-mix asphalt paving at a rate of 0.05 to 0.15 gal./sq. yd.

C. Patching: Fill excavated pavements with hot-mix asphalt base mix and, while still hot, compact flush with adjacent surface. Proof-roll subbase using heavy, pneumatic-tired rollers to locate areas that are unstable or that require further compaction. Immediately before

placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving. Sweep loose granular particles from surface of unbound-aggregate base course. Do not dislodge or disturb aggregate embedded in compacted surface of base course.

3.2 HOT-MIX ASPHALT PLACING

A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.

3.3 COMPACTION

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or vibratory-plate compactors in areas inaccessible to rollers. Complete compaction before mix temperature cools to 185 deg F.

B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct lay down and rolling operations to comply with requirements.

C. Average Density: 95 percent of reference maximum theoretical density according to ASTM D.

END OF SECTION

SECTION 02831

CHAIN LINK FENCE

PART 1 GENERAL

1.1 WORK INCLUDED

A. The chain link fence will be installed along wetlands buffer on the northeast corner of the site as shown on the construction drawings.

1.2 QUALITY ASSURANCE

A. Erector shall be a Contractor regularly engaged in installation of similar fencing.

1.3 SUBMITTALS

A. Certification of quality of all fence elements.

B. Submit results of ASTM A90 test for zinc coating weight.

PART 2 PRODUCTS

2.1 GENERAL

A. Posts, rails, rods, bars, fittings and hardware shall be hot-dipped, zinc-coated steel per ASTM Specifications A120, A123 and A153, as applicable.

B. Fence components to be galvanically compatible.

2.2 CHAIN LINK FABRIC

A. Chain link in accordance with ASTM A392, high carbon steel, zinc-coated Class II (2.0 ounces per square foot).

B. No. 9 gauge x 2-inch mesh, hot-dipped after weaving, twisted and barbed at top and bottom selvages.

C. 72-inch height (fabric roll width) or size as matches the existing fencing.

2.3 POSTS

A. Terminal Posts: All end, corner and pull posts, 3 inch O.D. standard pipe, 5.79 pounds per lineal foot (deflection in horizontal fence line of 15º or more requires a terminal post).

B. Intermediate Posts: "H" column, 2-1/4 inch x 2 inch, 4.1 pounds per lineal foot; or 2-1/2-inch O.D. pipe, 3.65 pounds per lineal foot.

C. Post Braces: 1-5/8 inch O.D. pipe, 1.17 pounds per lineal foot.

D. All posts shall be provided with tops as required.

2.4 ATTACHMENTS

A. Truss Rods: 3/8 inch diameter round rod.

B. Tension Bars (Stretcher Bar): 1/4 inch x 3/4 inch flat, high carbon steel.

C. Tension Wire (Top and Bottom): No. 7 gauge, galvanized coiled spring wire.

D. Fittings and Hardware: All standard fittings required for the complete fence assembly including gates shall be malleable cast iron or pressed steel. All ferrous material shall be hot-dipped galvanized.

2.5 CONCRETE

A. Consistency requirement at 6 inch maximum slump.

PART 3 EXECUTION

3.1 CHAIN LINK FENCE INSTALLATION

A. General

1. Install by skilled personnel experienced in erection of chain link fence and gates.

2. The fence alighment will be as shown on the Plans. Deviations in alignment to miss obstacles will be permitted only when approved by the OWNER.

B. Clearing, Grubbing and Grading

1. Clearing and Grubbing is to be performed as needed in accordance with Section 02230.

2. Grading of the fence line sufficiently to prevent ground clearance exceeding 6 inches or short and abrupt breaks in the ground contour that will affect the aesthetic appearance of the top of the fencing when installed shall be required. It is expected that in the performance of this work, hand work may be required where sufficient width does not exist for machine work.

C. Posts

1. Posts shall be set vertically and spaced at 10-foot centers measured parallel to slope of ground.

2. Set all posts except line posts in concrete footings to minimum depth of 36 inches.

3. Line posts shall be set in undisturbed earth by driving or drilling. Driving shall not damage post. Any voids around post shall be filled and thoroughly tamped.

4. Diameter of footings: Minimum of 9 inches, except gate hinge posts 3 times diameter of the post.

5. Concrete shall be worked thoroughly to remove voids and crowned to carry water away from the post.

6. Install pull post at 1,000 feet maximum intervals.

7. Install post braces and adjustable truss rods at corners, gates, pull posts or as detailed on approved submittal drawings.

8. Install so posts are plumb when diagonal rod is under tension.

9. Equip posts with tops designed to exclude moisture from posts.

D. Tension Wire:

1. Install top tension wire, top rail not required except at corners and gates.

2. Install bottom tension wire along bottom 2 inches above finish grade.

3. Stretch tension wire prior to fabric stretching and fasten to terminal posts.

4. Secure chain link fabric to tension wire with 11 gauge hog rings spaced 24 inches apart.

E. Chain Link Fabric:

1. Stretch taut and securely fasten to posts.

2. Fasten chain link fabric to all terminal posts by tension bars with heavy one inch by 11 gauge pressed steel bands spaced 14 inches apart.

3. Fasten to line posts with 2 gauge wire clips spaced 14-inches apart.

F. Gates:

1. Install freely swinging gates as indicated on Plans.

2. Gate shall be of same material as chain link fabric.

END OF SECTION

SECTION 02900

PLANTING

PART 1 GENERAL

1.1 SUMMARY

A. The scope of work consists of furnishing all labor, equipment, and materials to establish trees and shrubs, emergent plants, hardwood cuttings, and seeds as noted on the Plans and in the Plant Schedule. The Plant Schedule provides the quantities, scientific names, common names, sizes, and other remarks for plants to be installed at the site. Required items of Work include furnishing materials and completing planting. The ENGINEER will field monitor wetland mitigation site hydrology following grading and may adjust planting recommendations and plan notes relative to actual hydrologic conditions. If this occurs, any cost implications will be negotiated between OWNER and CONTRACTOR before planting work commences.

1.1 SCOPE

A. The work consists of furnishing all labor, equipment, and materials in order to perform the work as identified in Section 01010 – Summary Description of Work.

B. Work shall be completed in accordance with Plans.

1.2 QUALITY CONTROL

A. During wetland planting activities, the CONTRACTOR shall provide on site at all times at least one individual who is capable of identifying the desired plant species, is familiar with their proper care, and who shall supervise the transport and storage of plants.

B. Areas outside the limit of disturbance shall be protected from damage by the CONTRACTOR.

1.3 CLEAN UP

A. The CONTRACTOR shall keep all areas of work clean, neat, and orderly at all times; keep all paved areas clean during planting and maintenance; and remove waste materials, such as flats, can, boxes and burlap, from the entire work area upon completion of work to the satisfaction of the OWNER.

1.4 WORK SCHEDULE

A. Bare-root and containerized plantings, and hardwood cutting shall be installed between November 1 and December 31, following the notice to proceed by the Owner. Hydroseed shall be applied during the fall or spring months according to CONTRACTOR hydroseed recommendations.

1.5 PERFORMANCE PERIOD AND REPLACEMENTS

A The CONTRACTOR shall provide newly planted or replanted trees and shrubs that are in satisfactory condition at Final Acceptance to the following standards: Native vegetation shall achieve 50% aerial coverage during year one and 70% aerial coverage during year two, barring extreme weather conditions (such as prolonged drought). For the purposes of this requirement, the completion of the first year performance period shall be October 15 following the first full growing season. The second year performance period shall be one calendar year after that. Native vegetation is described as species indigenous to the Pacific Northwest as defined by Hitchcock and Cronquist *Flora of the Pacific Northwest* and/or The U.S. Department of Agriculture Natural Resource Conservation Service PLANTS Database (http://plants.usda.gov/). Aerial coverage shall be assessed by a qualified botanist or other such person as directed by the OWNER.

B. Any delay in completing planting shall extend the performance period correspondingly.

C. The CONTRACTOR shall replace dead plants to the extent necessary to meet the requirements in Section 02900, Part 1.5 A at the end of each performance period. Dead plants in excess of the maximum mortality shall be identified by the ENGINEER and the replanting plan shall be approved by the OWNER. Required replanting work will be performed following the dates specified in Section 2900 1.4 A, or as specified by the OWNER.

D. Replacement plants shall closely match adjacent living specimens of the same species and shall be subject to all requirements of this Specification.

E. The CONTRACTOR shall not be held responsible for failures due to vandalism or extreme weather conditions (such as prolonged drought) during the guarantee period.

PART 2 MATERIALS

2.1 SEED, TRANSPLANTING, HARDWOOD CUTTINGS, TREE, SHRUB, AND EMERGENT PLANTINGS

A. The Plant Schedule provides the quantities, scientific names, common names, sizes, and other remarks for plants to be installed at the site.

PLANT SCHEDULE – NORTHWEST PIPE AND CASING / HALL PROCESS COMPANY

Emergent Wetland (0.7 Total Acres)					
Scientific Name	**Common Name**	**Size**	**Minimum spacing on center**	**Total Quantity**	**Comments**
Trees					
Alnus rubra	Red alder	2-year old bare-root	12 ft	50	Clusters of 3
Fraxinus latifolia	Oregon ash	2-year old bare-root	12 ft	50	
Salix lasiandra	Pacific willow	Bare-root or Plug	12 ft	50	
Shrubs					
Salix sitchensis	Sitka willow	24-36" live cutting	10 in	200	Clusters of 5 on banks of ditch. Space clusters 12' o.c.
Spiraea douglasii	Douglas spiraea	Bare-root or Plug	8 ft	300	
Emergents/Grass					
Beckmannia syzigachne	American sloughgrass	Bare-root or Plug	6 in	1,400	Clusters of 3 or more
Carex obnupta	Slough sedge	Bare-root or Plug	6 in	1,400	Clusters of 3 or more
Carex stipata	Saw-beak sedge	Bare-root or Plug	6 in	1,400	Clusters of 3 or more
Deschampsia cespitosa	Tufted hairgrass	Bare-root or Plug	6 in	1,400	Clusters of 3 or more
Juncus accuminatus	Tapered rush	Bare-root or Plug	6 in	1,400	Clusters of 3 or more
Juncus effusus	Common rush	Bare-root or Plug	6 in	1,400	Clusters of 3 or more
Juncus patens	Spreading rush	Bare-root or Plug	6 in	1,400	Clusters of 3 or more
Forested Wetland (0.3 Total Acres)					
Scientific Name	**Common Name**	**Size**	**Minimum spacing on center**	**Total Quantity**	**Comments**
Trees					
Alnus rubra	Red alder	2-year old bare-root	4 ft	200	
Fraxinus latifolia	Oregon ash	2-year old bare-root	6 ft	100	
Salix lasiandra	Pacific willow	Bare-root or Plug	6 ft	100	
Populus balsamifera var. trichocarpa	Black cottonwood	2-year old bare-root	6 ft	100	

Shrubs					
Salix scouleriana	Scouler's willow	Plug	4 ft	100	Planted at lowest grade within this zone
Salix sitchensis	Sitka willow	Plug	4 ft	200	Planted at lowest grade within this zone
Grass					
Red fescue	Festuca rubra	Seed	10 lbs/acre	1/3 lb	Hand broadcast seed
Upland Buffer (0.84 Total Acres)					
Scientific Name	**Common Name**	**Size**	**Minimum spacing on center**	**Total Quantity**	**Comments**
Trees					
Acer macrophyllum	Big-leaf maple	Bare-root	7 ft	375	
Quercus garryana	Oregon white oak	1 gallon	7 ft	400	
Shrubs					
Cratageous douglasii	Black hawthorn	Bare-root	5 ft	200	
Rubus ursinus	Trailing blackberry	Bare-root	4 ft	300	
Symphoricarpos albus	Snowberry	Plug	3 ft	1,000	
Grass/Herbs					
Bromis carinatus	California brome	Seed	10 lbs/acre	10 lbs	Hydroseeded
Elymus glaucus	Blue wildrye	Seed	9 lbs/acre	9 lbs	Hydroseeded
Epilobium angustifolium	Fireweed	Seed	1 lbs/acre	1 lb	Hydroseeded
Festuca idahoensis spp. roemeri	Roemer's fescue	Seed	10 lbs/acre	10 lbs	Hydroseeded
Lupinus albicaulis	Sickle-keeled lupine	Seed	1 lbs/acre	1 lb	Hydroseeded
Red fescue	Festuca rubra	Seed	10 lbs/acre	10 lbs	Hydroseeded
Vicia americana	American vetch	Seed	2 lbs/acre	2 lbs	Hydroseeded
Soil Cap Area (29 Total Acres)					
Scientific Name	**Common Name**	**Size**	**Minimum spacing on center**	**Total Quantity**	**Comments**
Grass/Herbs					
Bromis carinatus	California brome	Seed	10 lbs/acre	290 lbs	Hydroseeded
Elymus glaucus	Blue wildrye	Seed	9 lbs/acre	261 lbs	Hydroseeded
Epilobium angustifolium	Fireweed	Seed	1 lbs/acre	29 lbs	Hydroseeded
Festuca idahoensis spp. roemeri	Roemer's fescue	Seed	10 lbs/acre	290 lbs	Hydroseeded
Lupinus albicaulis	Sickle-keeled lupine	Seed	1 lbs/acre	29 lbs	Hydroseeded
Red fescue	Festuca rubra	Seed	10 lbs/acre	290 lbs	Hydroseeded
Vicia americana	American vetch	Seed	2 lbs/acre	58 lbs	Hydroseeded

2.2 HYDROMULCH FIBER

A. Hydromulch fiber shall be weed-free straw or rice straw fiber composed exclusively of green plant material (leafy material as opposed to woody material).

2.3 MULCH

A. Contaminant levels in the mulch shall not exceed those established for Grade AA compost, given in Table 3 of the Interim Guidelines for Compost Quality, published by the Washington State Department of Ecology, nor soil cap requirements as specified in Section 02300 3.1.

B. Mulch shall be screened organic matter made with starting material including predominantly sawdust, bark, or other brown woody material that has reached an internal temperature of 135 degrees (F) for 4 continuous days, has a total nitrogen content of 1/2 to 1-1/2 percent maximum, a pH of 5.5 to 8, and a moisture content of 35 to 55 percent. Mulch must be screened through a maximum 5/8 inch screen, or such that it will pass through a blower. A chemical analysis of product must be approved by the OWNER. Contact Soil Food Web (541) 752-5066 and Western Laboratories, Inc. 1-800-658-3858. The following biological parameters shall be tested, and the results provided to the OWNER with the results being in the range shown or below the maximum allowable as applicable:

Biological Parameters for Compost	
Parameter	**Acceptable Range**
Active fungi	15-25 ug/g
Total fungi	150-300 ug/g
Ratio total fungi to total bacteria	3:1 to 5:1
Ratio active fungi to active bacteria	approximately 2:1

C. CONTRACTOR shall provide analytical data for the compost to be used, demonstrating that the following contaminant levels are not exceeded.

Contaminant Levels in the Interim Guidelines for Compost Quality, Published by Washington State Department of Ecology (Modified)	
Parameter	**Allowable Level, Grade AA Compost**
PHYSICAL	
Percent of Manufactured Inerts	< 1 %
Sharps	None
Stability	See Appendix IV of Interim Guidelines for Compost Quality, Department of Ecology
CHEMICAL INORGANIC	
pH	5.5 – 8.0
Arsenic	20 ppm, or per Section 2300 3.1, whichever is lower
Cadmium	10 ppm, or per Section 2300 3.1, whichever is lower
Chromium[1]	450 ppm, or per Section 2300 3.1, whichever is lower
Copper	750 ppm, or per Section 2300 3.1, whichever is lower
Lead	150 ppm, or per Section 2300 3.1, whichever is lower

CHEMICAL INORGANIC (cont'd)	
Mercury	8 ppm, or per Section 2300 3.1, whichever is lower
Molybdenum	9 ppm, or per Section 2300 3.1, whichever is lower
Nickel	210 ppm, or per Section 2300 3.1, whichever is lower
Selenium	18 ppm, or per Section 2300 3.1, whichever is lower
Zinc	1400 ppm, or per Section 2300 3.1, whichever is lower
CHEMICAL ORGANIC	Also see Appendix III of Interim Guidelines for Compost Quality, Department of Ecology
PCBs	0.74 ppm, or per Section 2300 3.1, whichever is lower
Total Petroleum Hydrocarbons (TPH)-gasoline	100 ppm, or per Section 2300 3.1, whichever is lower
TPH-diesel	200 ppm, or per Section 2300 3.1, whichever is lower
TPH-other	200 ppm, or per Section 2300 3.1, whichever is lower
BIOLOGICAL	
Fecal coliform	Meet or exceed Class A requirements for biosolids.

2.4 MULCH FOR HARDWOOD CUTTING

A. Mulch shall not be installed for hardwood cuttings.

2.5 FERTILIZER

A. Fertilizer shall not be used during any stage of the project.

2.6 HERBICIDE

A. Herbicide shall not be used during any stage of the project. Noxious weeds shall be removed mechanically as directed by the OWNER.

2.7 SOIL CONDITIONERS

A. Soil conditioners shall not be used during any stage of the project.

2.8 STAKING AND GUYING MATERIAL

A. Staking is not recommended for trees and shrubs.

2.9 TREE GUARD

A. Tree guards shall not be installed.

2.10 TACKIFIER

A. Tackifier shall be any polysaccharide-based tackifier (such as guar gum).

PART 3 EXECUTION

3.0 GENERAL

A. Upon completion of site preparation, excavation, and grading, planting shall occur according to the schedule in Section 02900.1.4.A, or as specified by OWNER.

B. The number and general layout of woody trees and shrubs, hardwood cuttings, and emergent plants is described on the planting plans and Plant Schedules. Exact plant locations will be determined and identified in the field by the CONTRACTOR and approved by the OWNER prior to planting. Layout will consist of identifying all planting areas by wetland habitat type, and laying out the plant material by species with color coded stakes. The CONTRACTOR will lay out three 10' x 10' typical plots of each habitat type as an example. After inspection and approval by the OWNER, planting will commence.

3.1 HYDROMULCH FIBER

A. Straw hydromulch with seed application shall be applied (to all locations identified to receive seeding) at the following rate:

Material	Rate
hydromulch	2,000 lbs/ac
tackifier	80 lbs/ac

B. The CONTRACTOR shall agitate hydroseed slurry mix periodically as necessary to ensure an even mix of ingredients.

3.2 MULCH

A. The CONTRACTOR shall blow two to three inches of composted mulch around all woody plants as shown on the Plans (two inches for seedlings and tubelings). If any areas are not accessible to equipment, mulch shall be spread by hand in those areas. Mulch shall not be placed around hardwood cuttings.

3.3 FINAL ACCEPTANCE

A. The CONTRACTOR shall request the inspection in writing to the OWNER seven (7) days before the completion of work in each area of planting and for each type of planting in order that a mutually agreeable time for inspection may be arranged.

B. The OWNER, CONTRACTOR, ENGINEER and others, at the OWNER's direction, shall be present at the inspection.

C. If, after the inspection, the OWNER is of the opinion that all work has been performed as per the Plans and Specifications and that all plant materials are in satisfactory growing condition, he will give the CONTRACTOR written notice of acceptance. The 1- and 2-year guarantee period begins as specified in Section 2900 1.5A.

3.4 MAINTENANCE

A. Maintenance of the wetland mitigation site shall be the responsibility of the CONTRACTOR for one (1) calendar year from the date installation is completed.

B. Maintenance activities shall include removal and off-site disposal of noxious and invasive non-native weeds, and other activities in order to ensure the success criteria of installed vegetation is met.

C. The wetland mitigation site shall be inspected by the CONTRACTOR throughout the year to determine the need for appropriate timing of maintenance activities.

D. No fertilizers or herbicides shall be used during maintenance activities.

E. Watering, if required, shall be at the expense of the CONTRACTOR.

F. Weeding

1. The extent of weed encroachment shall be assessed during the course of the growing season. Populations of noxious weeds and invasive non-native vegetation that are determined to significantly affect the installed vegetation shall be removed by the CONTRACTOR by hand, ensuring that native vegetation is not disturbed.

2. Non-native vegetation that is removed shall be bagged in plastic and disposed of offsite at a permitted landfill.

END OF SECTION

SECTION 02912

EMERGENT PLANTS

PART 1 GENERAL

1.1 SUMMARY

A. This section defines installation requirements for emergent plants.

B. The term "emergent plant" is defined as young dormant or growing plants to include: rhizomes, and bare root. The appropriate propagule (plant part that can be separated and used to grow a new plant) will vary depending on the plant and sometimes the season collecting or planting is being done.

PART 2 MATERIALS

2.1 GENERAL

A. Any substitutions of plant material shall be approved by the OWNER.

B. Plants shall be obtained from pre-approved nursery stock originating from western Oregon. The OWNER shall approve the source, quality, and propagule of planting stock before digging or planting begins.

C. The CONTRACTOR shall, in furnishing or processing a plant propagule, use standard horticultural industry practices for the species and variety. In case of conflicting opinions about appropriate horticultural techniques, the OWNER will approve allowable practices.

D. Plants shall be kept cool and moist at all times while transporting or handling. Plants shall be kept in short-term storage no longer than two days. After two days, plants shall be transferred to a nursery for longer-term storage or stored by other means as approved by the OWNER. Plant materials shall be planted within four hours of removal from nursery or long-term storage areas.

E. Planting stock shall be handled and transported by methods that prevent damage to the planting stock. The OWNER shall approve planting stock upon delivery. Dry root systems, or damaged critical plant parts are grounds for rejection of planting stock.

F. Plant species, sizes, and quantities are listed in the Plant Schedule in Section 02900. The OWNER may approve CONTRACTOR-recommended substitutions, as appropriate, based on plan availability, site conditions, or other project factors.

PART3 EXECUTION

3.1 GENERAL

A. The CONTRACTOR shall space plants as shown on the Plans and Plant Schedule.

B. Propagules shall be positioned so that after settling, the green top growth is at the same

level as it grew naturally. Dormant propagules, such as rhizomes, shall be planted at a depth of 1 to 2 inches or as recommended by the plant supplier. The soil shall be gently compacted around the plants to prevent float-out and ensure good establishment. Plant holes shall be dug large enough to spread out the root system evenly around the plant.

C. Plant when the temperatures are below 65 degrees (F) and above 32 degrees (F) so that plants are dormant, preferably at the beginning of the dormant season between November and December. The OWNER may halt work if conditions become unfavorable for planting.

END OF SECTION

SECTION 02913

TREES AND SHRUBS

PART 1 GENERAL

1.1 SUMMARY

A. This section defines installation requirements for trees and shrubs.

PART 2 MATERIALS: TREES AND SHRUBS

2.1 GENERAL

A. Any substitutions of plant material shall be approved by the OWNER.

B. Plant species, sizes, and quantities are listed on the Plant Schedule by planting area in Section 02900.2.1.A.

C. If specified planting material is not obtainable, the CONTRACTOR shall document proof of non-availability and provide recommendations for substitutions, subject to OWNER approval. The OWNER shall approve acquisition of all specified plant material. All stock is to be grown from either propagules or seed collected from and grown within western Oregon sources only.

D. Plants shall be subject to inspection and approval by the OWNER at the place of growth or upon delivery for conformity to Specifications. All plant material suppliers will provide a shipping certificate with each load or lot of plant materials containing the following information:

- name of plants (common and botanical)
- number of plants
- size of plants
- name of nursery and location of materials where propagated or grown
- statement that plants supplied were propagated from either seeds or cuttings originating in western Oregon.

Such approval shall not impair the right of inspection and rejection of plant material during progress of the work.

E. Substitutions of plant materials must be authorized by OWNER.

F. For delivery to site, all plants shall be packed to provide protection against damage from wind and weather.

G. Nursery-grown plants shall be grown in accordance with good horticultural practices under conditions similar to those of the project site for at least two years.

H. All plants shall be free of disease, insect pests, eggs, or larvae, and shall have healthy, well developed root systems. They shall be free of dead or dying branches and branch

tips, free from excessive physical damage as determined by the OWNER and protected from adverse conditions that would prevent thriving growth.

I. Nursery-grown plants shall be true to species and variety and shall conform to measurements specified. Plants shall be measured when branches are in their normal position. Dimensions specified refer to main body of plant (not branch tip to tip).

J. The Plant Schedule in Section 02900.2.1.A shows the plant material to be installed in each area by wetland habitat type. The OWNER may make CONTRACTOR-recommended substitutions, as appropriate, based on plan availability, site conditions, or other project factors.

PART 3 EXECUTION

3.1 GENERAL

A. The CONTRACTOR shall space plants as shown on the Plans and Plant Schedule.

B. Plants shall be planted at a depth as recommended by the plant supplier. The soil shall be gently compacted around the plants to prevent float-out and ensure good establishment. Plant holes shall be dug large enough to spread out the root system evenly around the plant.

C. Plant when the temperatures are below 65 degrees (F) and above 32 degrees (F) so that plants are dormant, preferably at the beginning of the dormant season between November and December. The OWNER may halt work if conditions become unfavorable for planting.

D. All installed plants shall be protected from damage by heavy equipment or materials during the course of planting operations.

3.2 TEMPORARY NURSERY

A. A temporary nursery may be used to store plants. Plants in the temporary nursery shall be kept well watered and protected. Plants may be stored in moist media (such as native soil, sand, or sawdust).

B. The CONTRACTOR shall handle all balled and burlapped plants by the ball only.

C. The CONTRACTOR shall handle container plants by the container.

D. The CONTRACTOR shall inspect and mist emergent propagules, tubelings, and bare root seedlings to prevent plants from drying out.

E. Temporary nursery may be located onsite.

3.3 DIGGING AND HANDLING OF PLANTS

A. Container stock shall be carefully removed. Container plants shall not be lifted or handled by tops, stems, or trunks.

B. Undue drying of the roots because of exposure to air and sun shall be avoided. Roots shall be kept well covered and moist until the plants can be placed in the final location and permanently planted.

C. All of the root system of bare roots plants shall be kept intact; the root system shall not be pruned. However, any roots that are broken, crushed, or bruised shall be cleanly cut back to sound wood. The cut shall be made on an angle so that the exposed end faces downward.

3.4 WILLOW CUTTINGS

A. Willow Cuttings shall consist of dormant, healthy, vigorous, 1-to 3-year old propagation wood collected from approved collection sites within western Oregon. Cuttings shall be inspected by the OWNER and will be labeled as to common and scientific name, and location where obtained.

B. Cutting stock shall be gathered and planted on the same day, if possible. Cuttings shall not be gathered if temperatures are below 32 degrees (F). Cuttings shall be protected from sun, wind, freezing, drying or injury before and during planting. The collection, transport, and storage methods shall be approved by the OWNER.

C. Willow Cuttings shall be ½ to 1 ½ inches in diameter cut to 24-36 inches in length. Willow cuttings shall be installed in the same direction as they grew on the parent tree, inserted to a depth of two-thirds their length below ground. All cuttings shall be installed in areas where at minimum the lower 3 inches of the planting hole is saturated or inundated with water.

D. If Cuttings cannot be manually inserted to the required depth, the cutting hole will be pre-formed with a hammer and metal rod. Cuttings shall not be hammered into the soil.

3.5 BARE ROOT SEEDLINGS AND TUBELINGS PLANTING OPERATIONS

A. Plants shall be spaced at a variable spacing as shown on Plans to simulate natural appearance. If there is a discrepancy on the plant lists between the given spacing and the overall quantity of plants, the overall quantity shall prevail.

B. Pits shall be dug for trees at twice the diameter of the root ball. Trees and shrubs shall bear same relationship to grade as they did in the nursery. The subgrade in pits and beds shall be loosened to a depth of 3 inches. Standing water in a plant will require corrective measures to be recommended by CONTRACTOR and approved by OWNER.

C. Soil surrounding the planting hole shall be loosened or otherwise aerated to allow for water to pass through the planting hole without accumulating or pooling around the plant. No planting well, or saucer, shall be created around the plant.

D. Plants shall be removed from their containers, and the side of rootballs gently rolled or loosened by hand to prevent rootbound condition.

E. All plants shall be set plumb or straight and centered in the pit. Plants shall be placed at such a level that, after settlement, the crown of the plant shall be even with the

surrounding ground surface. Planting holes shall be free of large amounts of green matter (fresh leaves, twigs or other uncomposted material).

F. Each plant pit shall be backfilled with native soil. When about two-thirds of the hole has been backfilled, the hole shall be filled with water (as weather makes necessary) and the soil allowed to settle around the roots. After the water has been absorbed, the hole shall be filled and tamped to grade. The CONTRACTOR shall ensure no settlement below grade by adding native soil as necessary.

3.6 WATERING

A. All plantings shall be watered immediately after planting. No further irrigation is specified.

END OF SECTION

SECTION 02914

SEEDING

PART 1 GENERAL

1.1 SUMMARY

A. Soil Cap and upland buffer seeding shall consist of hydroseeding with tackifier and then blowing dry straw hydromulch fiber at all disturbed areas within the construction limits shown on the Plans.

B. The wetland mitigation site shall not be hydroseeded. The forested and emergent wetlands will be seeded manually.

C. The Upland Buffer shall be hydroseeded prior to planting of other species.

D. The Soil Cap shall be hydroseeded upon completion of all soil placement activities or as approved by OWNER.

PART2 MATERIALS

2.1 GENERAL

A. Any substitutions of plant material shall be approved by the OWNER.

B. Seed mixture shall be provided in sealed containers clearly labeled to show the following:

- Name and address of the supplier
- Kind and variety of seed
- Place of origin (western Washington, Oregon or British Columbia)
- Lot number
- Percentage of weed seed (not to exceed 0.10%)
- Percent and kind of other crop
- Percent of inert (not to exceed 1.5 %)
- Guaranteed percent purity (85% minimum)
- Guaranteed percent germination (80% minimum)
- Year of production
- Pure live seed gross weight
- Date of test
- Date packaged
- Location where packaged

C. This information shall be obtained from the supplier by the CONTRACTOR and submitted to the OWNER for review and acceptance. Each lot of seed shall be subject to inspection. Seed that is not labeled or that does not conform to Specifications may be rejected by the OWNER. All seed furnished shall be free of non-native seeds such as Russian or Canada thistle, reed canary grass, European bindweed, and leafy spurge. Seed that has become set, moldy, or otherwise damaged in transit or storage is not acceptable. Seed in damaged packaging is not acceptable. Each lot of seed furnished shall be labeled "Oregon Certified

Seed," or equivalent from another state. All seed must be grown in western Oregon or western Washington. No wild collected seed shall be used on this project without approval of the OWNER. Determination on the use of substitute seed will be made by the OWNER, if necessary.

D. Seed mixes shall be according to Plant Schedule in Section 02900.2.1.A.

E. Any areas disturbed shall be revegetated with the Upland Buffer seed mix. Such areas shall be determined in the field and are in addition to the acreage shown in the Planting Schedule.

PART 3EXECUTION

3.1 GENERAL

A. Unless otherwise specified or approved, the CONTRACTOR shall perform this work as specified in this section. Required reseeding may be conducted during subsequent fall or spring seasons.

3.2 SEED BED PREPARATION AND TREATMENT

A. Upon completion of wetland mitigation site excavation, grading, and placement of topsoil, the OWNER shall verify that the prepared soil base is in a condition favorable for germination of seed and growth of grass and herbaceous plants. The OWNER shall evaluate if there are significant areas with weed growth. With OWNER's approval, the Contractor shall first use mechanical means to remove weeds. The seed bed shall be rolled with a corrugated roller to provide a good germination medium. Soil clods shall not be larger than 3 inches. Surface preparation operations shall be conducted along the contours of the areas involved. On cut slopes, the CONTRACTOR shall form minor ridges and irregularities parallel to the contours to retard erosion and improve germination.

B. Method and rate of seed application:

1. Hydroseed: Hydroseed as specified with mixture of tackifier at 80 lb/ac, hydromulch at 2,000 lb/ac, and seeds as specified in plant list. No fertilizers or soil conditioners shall be used within the hydroseed slurry.

2. Manual: Uniformly apply seed to wetland and upland buffer areas using a hand-held broadcast seeder. Seed species may be broadcasted in one pass if even distribution of each species is ensured. If seed sizes cause uneven distribution using the broadcaster, seeding the area one species at a time may be necessary.

C. The seed shall be distributed uniformly over the entire area. Seeding shall not proceed on days that, in the opinion of the OWNER, are excessively windy or rainy.

END OF SECTION

SECTION 02915

HABITAT ATTRIBUTES

PART 1 GENERAL

1.1 SUMMARY

A. This section defines installation requirements for wetlands habitat.

PART 2 MATERIALS

2.1 DEAD AND DOWN WOODY DEBRIS

A. Dead and down woody debris consists of logs and slash piles within the wetland mitigation site and the upland buffer. The OWNER will stake and approve final locations of material. Logs and slash piles shall be from trees being removed from the project site.

2.2 ROCK & CONCRETE HABITAT STRUCTURES

A. CONTRACTOR shall install rock and concrete habitat structures within the upland buffer using the existing pile of boulders and concrete in the wetland mitigation site, as shown on the Plans. The OWNER will stake and approve final locations of materials.

B. The rock habitat structure shall be reconstructed to the approximate height and width of the existing rock pile. Dirt, construction debris, litter, and other materials shall not be placed within the rock habitat structure.

C. The concrete habitat structure shall be reconstructed to the approximate height and width of the existing concrete pile. Slabs of concrete shall be placed flat, 6-18 inches apart (largest spacing on the lowest layer) to allow for wildlife refuge. The top layer of slabs shall be placed to protect the ground underneath from the weather, with narrow to no spacing between slabs.

PART 3 EXECUTION

3.1 DEAD AND DOWN WOODY DEBRIS

A. Install woody debris in quantities shown in part 2.1 of section 02915.

3.2 ROCK AND CONCRETE HABITAT STRUCTURES

A. Install as indicated on the Plans, for a total of 2 refuges.

END OF SECTION

DIVISION 3

CONCRETE

SECTION 03200

CONCRETE REINFORCEMENT

PART 1 GENERAL

0.1 RELATED WORK SPECIFIED ELSEWHERE

A. Cast In Place Concrete: Section 03300

0.2 QUALITY ASSURANCE CONTROL

A. Manual of Standard Practice for Detailing Reinforced Concrete Structures, ACI 315.

B. Manual of Standard Practice, Concrete Reinforcing Steel Institute.

0.3 SUBMITTALS

A. Placing drawings, bending and cutsheet schedules.

B. Mill test reports for each shipment of reinforcement shall be submitted to OWNER for review.

0.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver reinforcement to project site in bundles marked to coordinate with placement drawings.

B. Handle and store to prevent contamination from dirt, oil and other materials which will affect bond.

C. Store a minimum of 6" above ground and in locations where the materials will not be subject to abuse.

1. PRODUCTS

1.1 MATERIALS

A. Reinforcing Bars: Unless specified otherwise, deformed bars meeting requirements of ASTM A615, Grade 60. Supplementary Requirements S1 shall apply.

B. Tie Wire: Steel, black annealed, 16-gauge minimum.

C. Reinforcing Bar Supports: Per CRSI Manual Chapter 3, pregalvanized or plastic-coated.

2. EXECUTION

2.1 INSTALLATION

A. Placement and Tolerances: Conform to CRSI "Manual of Standard Practice".

B. Splices:

1. Do not splice bars unless otherwise approved.

2. Tie lap slices securely with wire to prevent displacement of splice during placement of concrete.

3. Perform welded splices in accordance with ACI Building Code (ACI 318).

C. Cleaning: Remove dirt, grease, oil, loose mill scale, excessive rust, and foreign matter that may reduce bond with concrete.

D. Protection During Concreting: Keep reinforcing in proper position during concrete placement.

E. Concrete Cover: Maintain minimum concrete cover over reinforcement as specified in ACI 318 or as noted.

END OF SECTION

SECTION 03300

CAST IN PLACE CONCRETE

PART 1 GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Concrete Reinforcement: Section 03200

1.2 QUALITY ASSURANCE

A. Delivery: Furnish a certificate with each truckload of concrete product delivered to the site, indicating the composition and quality of the mix. Include size and weight of each aggregate, amount of cement, amount of water and amount and kind of any additives included in the concrete, grout fill, or mortar.

B. Standards: All applicable standards of the following:

1. American Concrete Institute – ACI

2. Concrete Reinforcing Steel Institute – CRSI

3. Uniform Building Code – UBC

4. Other local codes or criteria noted on drawings.

C. Concrete Consistency:

1. Test each truckload of concrete for slump. Calibrate each mixer or haul unit to be used by measuring slump near the beginning and near the end of the discharge cycle. Mix units determined by OWNER to be deficient in mixing capability shall not be used in subsequent deliveries. Slump testing procedures per ASTM C143.

2. Consistency per values below with tolerance of $\pm$ 1 inch.

a. 2-3 inches slump for structural elements 12 inches and greater in thickness.

b. 2-4 inches slump for structural elements less than 12 inches in thickness and columns.

D. Concrete Test Cylinders:

1. Prepare a minimum of three test cylinders for each concrete load.

2. Test set of 3 cylinders as follows:

a. One at 7 days.

b. Two at 28 days.

3. Prepare and test cylinders per ASTM C31 and C39.

E. Prior to placement have available at placement location all tools, cylinder molds, slump cone, rod, curing containers and all other apparatus required for sampling and testing.

F. Air Entrained: One test for each mix design.

1.3 SUBMITTALS

A. Concrete mix design (for each concrete type used) by independent laboratory, including strength tests of 3 cylinders proportioned to mix design formula. Submit for OWNER approval prior to placement of concrete.

B. Certification of quality of all concrete, mortar, and grout mix design ingredients including admixtures with supporting test data, mill quality control results and all information specified and requested by OWNER. Submit for OWNER approval prior to placement of concrete.

C. Qualifications of Quality Assurance Control personnel responsible for concrete consistency, strength, air content and all testing. Submit for OWNER approval prior to placement of concrete.

D. Curing materials and methods proposed with certification statements of materials quality. Submit for OWNER approval prior to placement of concrete.

E. Test results, in approved format, at specified intervals for all field sampling and specimens.

F. Trip tickets for each load of concrete, grout or mortar indicating weights of all materials and additives used in the batch.

1.4 STORAGE OF MATERIALS

A. Maintain in continuously clean environment and in manner required to maintain homogeneity.

B. Cements, grouts, and mortar containerized and kept in dry humidity environment. OWNER shall reject materials which have hardened or show any evidence of initial hydration.

PART 2. PRODUCTS

2.1 CONCRETE

A. ASTM C94 and mix design approved by OWNER.

B. Compression strength and water cement ratio: The minimum compressive strength and cement content of concrete shall be not less than that shown in the tabulation that follows. The OWNER may order the cement content for any class of concrete to be increased over the quantity specified in the tabulation if it is determined that such increase is necessary to attain the required strength. Such increased quantities of cement, if so ordered, shall be furnished by the CONTRACTOR at no additional cost to the OWNER.

Class of Concrete

Min. 28-day Compr. Strength (psi)	Type of Work	Max. Size Aggregate (in.)	Min. Cement Pounds Per Cu. Yd..	Max. W/C Ratio
4,000	Slabs on grade	1-1/2	564	0.45

C. Cement ASTM C150:

1. Type II for all wastewater holding or process structures.

2. Type I or II for all other structures.

D. Aggregates:

1. Conform to ASTM C33.

2. Maximum wear 50% at 500 revolutions, AASHTO T96.

E. Water:

1. Clear free from injurious amounts of oil, acid, salt, alkali, organic matter, or other deleterious substances.

F. Admixtures:

1. Use only those specified in approved mix design.

2. Air entrain all concrete unless elsewhere excepted, with agent conforming to ASTM C260. Freshwater concrete air content between 4% and 6% by volume.

3. Apply in strict accordance with manufacturer's printed instructions.

4. No chloride contents permitted.

5. Compatible with coatings specified elsewhere.

2.2 AGGREGATE FOR MORTAR

A. Conform to 2.1 except gradation as follows:

Sieve Size Square Opening	Percent Passing By Weight
No. 4	95 - 100
No. 8	80 - 90
No. 16	55 - 97
No. 30	30 - 60
No. 50	12 - 30
No. 100	0 - 10

2.3 GROUT

A. For equipment and drilled in anchors use nonshrink, nonstaining, premixed grout, Masterflow 713 by Master Builders; or equivalent. Mix in accordance with the manufacturer's directions.

B. For Fill: Driest consistency practical composed of 1 part Portland Cement 3 parts sand (by volume). Aggregate proportions may be varied slightly to give the most workable mix.

C. For placement at base of walls, one part fine aggregate, one part cement. In a thick cream consistency.

D. Cure in accordance with manufacturer's recommendations.

2.4 CURING MATERIALS

A. Polyethylene Sheeting 0.004 inch thick.

B. Waterproof Paper: Polyethylene-coated, Fed. Spec. UU-B-790 Type I, Grades A, B, C, Style 4. Define lap control lines clearly by printed markings.

C. Masonry Sand: ASTM C144 (Maintained continually moist).

2.5 VAPOR BARRIER

A. Polyethylene sheeting 6 mil (0.006 inch) thickness. Define lap control lines clearly by continuously marking material edges.

B. Glass fiber reinforced waterproof paper coated with polyethylene (both sides). Fed. Sped. UU-B-790 Type I grades A, B, C Style 4. Define lap control lines clearly by printed markings.

PART 3. EXECUTION

3.1 MIXING AND TRANSPORTATION

A. Ready-Mixed Concrete: Conform to ASTM C94 Alternate No. 3.

3.2 PLACING

A. Deliver only in sufficient quantities required for specified time interval use and placement. Discard concrete having initial set before placement. No remixing with water or supplementing with other materials will be permitted once initial set has occurred. Initial set as evidenced by typical hydration characteristics to be determined by ENGINEER and CONTRACTOR quality assurance representative.

B. Place as nearly as possible to final position to avoid segregation of the materials and displacement of reinforcement. Placement shall be completed within 30 minutes after water is first added to the mix. However, at the OWNER's discretion if climatic and temperature conditions are suitable and when the concrete is continually agitated, the time may be extended to 1-1/2 hours.

C. Place no concrete in the absence of the ENGINEER.

D. Do not change consistency (slump) for a given placement without the OWNER's written permission.

E. Keep open trough and chutes of steel or steel lined, clean and free from coatings of hardened concrete.

F. Do not drop concrete a distance of more than 5 feet.

G. Care shall be taken in placing concrete through reinforcement so that no segregation of the coarse aggregate occurs.

H. Cold Weather Placement:

1. Concrete shall be placed only when the temperature is at least 40°F., and rising, unless permission to pour is obtained from OWNER.

2. Material shall be heated and otherwise prepared so that batching and mixing can proceed in full accord with the provisions of this Specification.

3. Suitable means shall be provided for maintaining the concrete at a temperature of at least 50°F for a period of at least the first five (5) days and at a temperature above freezing for the remainder of the specified curing period, except that where high-early-strength cement is used, this period may be reduced to 72 hours. The methods proposed for heating the materials and protecting the concrete shall be approved by OWNER.

4. Salt, chemicals, or other materials shall not be mixed with the concrete for the purpose of preventing freezing. Accelerating agents shall not be used.

I. Hot Weather Placement:

1. The temperature of fresh concrete at the time of placement during hot weather shall be a maximum of 90°F to prevent an accelerated setting of the concrete.

2. A retarding densifier admixture shall be used when the high expected atmospheric temperature for the day is 85°F or above. Admixture shall be used in accordance with the manufacturer's recommendations.

J. Placing Concrete Against Earth:

1. Unless otherwise called for on the drawings, earth cuts shall not be used as forms for vertical surfaces without the prior approval of OWNER.

2. Concrete placed on or against earth shall be placed only upon or against firm, damp surfaces free from frost, ice and standing or running water. Concrete shall not be placed upon mud, or upon fills until the required compaction has been obtained.

K. Placing Concrete Slabs:

1. Smooth subgrade surface irregularity with thin film of masonry sand prior to placing vapor barrier.

2. Place vapor barrier on subgrade in maximum widths commercially available. Longitudinal laps 6 inch minimum. End laps 2 feet minimum.

3. Edge and side laps to be in continuous contact. Place materials to maintain tight lap contact.

4. Repair any tears in the material.

5. Place concrete without displacing vapor barrier.

3.3 COMPACTING

A. Compact all concrete with high frequency internal vibrators immediately after placing.

B. Penetrate concrete with a sufficient number of vibrations immediately after it is deposited. Move vibrator throughout the mass so as to thoroughly work the concrete around reinforcement and embedded fixtures and into corners and form recesses. Vibrate the minimum time required to compact the concrete in place and not cause separation of the materials. Concrete shall be compacted to maximum density as determined by tests for yield. Select vibrator size to efficiently accommodate reinforcement clearances.

3.4 CURING AND PROTECTION

A. General:

1. Maintain at site ready to install, before actual concrete placing begins, all equipment and materials needed for optimum concrete curing and protection; maintain extra vibrators on standby in case of malfunction of any unit.

2. Protect finished surfaces or edges from stains, abrasions and breakage during the entire construction period.

3. Protect all concrete from accelerated drying and excessive heat at all times. Close all galleries, conduits and other formed openings through the concrete during the entire curing period and as long thereafter as practicable to prevent drying of concrete by air circulation.

4. Install slab curing covers immediately after initial set or as soon as free water has disappeared from the surface of the concrete after finishing or surfacing.

B. Water Curing:

1. Use water curing specified herein for all walls and slabs where watertight construction is required.

2. Keep concrete continuously wet by covering with an approved material or by a system of

perforated pipes or mechanical sprinklers or other approved methods. (Periodic wetting acceptable.)

3. Keep forms wet at all times to prevent opening of joints and the drying out of the concrete.

4. Water for curing shall be clean and free from any elements which might cause objectionable staining or discoloration of the concrete.

5. Cover surfaces completely with sheeting. Where a single sheet does not cover the entire surface, lap ends and edges at least 4 inches and continuously seal with tape or other suitable means recommended by the manufacturer.

6. Continue waterproof sheet curing for 7 days. Maintain sheeting and edge and end seals intact for entire period. Repair immediately any breaks in the sheeting envelope.

C. Curing Compounds (Use only when specifically approved and for optimum climatic conditions):

1. Do not use curing compounds unless their use is authorized in writing by OWNER. Curing compounds unacceptable where concrete is exposed to the direct rays of the sun or accelerated drying conditions.

2. Curing compounds shall not be used unless their use is face membrane type and shall be applied in accordance with the manufacturer's recommendations. They shall be of such composition and characteristics as will spread readily on moist concrete and deposit a hard, tenacious film without permanently coloring the concrete surfaces that will be exposed. The resultant film shall adhere to the concrete surface without chemical reaction therewith, and shall not peel. Maintain coverage for 28 days to prevent detrimental loss of water from the concrete.

3. Prior to applying curing compounds to formed surfaces, the surfaces shall be moistened with a spray of water immediately after forms are removed. Moistening shall be continued until the surfaces will not readily absorb more water. The compound shall be applied as soon as the moisture film has disappeared and while the surface is still damp.

4. On unformed surfaces, the compounds shall be applied immediately after finishing and after bleeding water and "shine" has disappeared.

5. Curing compounds shall not be used on surfaces where future bonding, painting or protective coating is required. In cold weather, curing compounds shall not be used on concrete surfaces that are kept at curing temperature by the use of steam.

D. Saturated Sand Curing:

1. Horizontal construction joints and finished surfaces, cured with sand, shall be kept covered with a minimum thickness of one inch of sand. It shall be kept uniformly distributed and continuously wetted with clean water for a period of 7 days.

3.5 REPAIRING CONCRETE

A. Immediately after removal of forms, break back all form ties and inspect concrete surfaces for defects. Complete repair of defects within 48 hours after removal of forms. No repairs shall be made until the defects have been reviewed and method of repair approved by OWNER.

B. Remove all defective or damaged concrete, including honeycombed, sand streaked, or fractured material from the area to be repaired. Chip out areas to one inch minimum depth. Edge shall be squared with the surface to eliminate feather edges.

C. Before placing the repair material obtain ENGINEER and OWNER inspection. Clean area free of chipping dust, dried mortar, and all other foreign materials.

D. Keep surfaces to be repaired continuously wet for at least three hours prior to placing new concrete or mortar. No free water on the surface when the repair material is placed.

E. Apply a bonding agent to the area to be repaired before placing repair material. Apply the bonding agent per manufacturer's published instructions attached to container.

F. For all repair surfaces permanently exposed to atmosphere use white cement in proportions found by trial to be effective in producing a color that, in the hardened patch, will match the surrounding concrete surface.

G. Make repairs or patch form tie holes by (1) dry-packing, (2) filling with concrete, or (3) plastering with mortar or a combination of all 3 in conformance with the following:

1. Use the dry-pack method for holes at least one inch deep where the depth is equal to, or greater than the smallest surface dimension of the defect, such as cone-bolt or form tie holes, and for narrow slots cut for the repair of cracks. Do not use the dry-pack method where lateral restraint cannot be obtained. Place and pack dry-pack mortar in layers having a compacted thickness of approximately 3/8 inch. Solidly compact each layer over its entire surface by use of a hardwood stick and hammer. Do not use metal tools for compacting. Compact surface just flush with adjacent area. Do not use steel finishing tools or water to facilitate finishing.

2. Use concrete replacement for (1) holes extending entirely through concrete sections; (2) for holes larger than one square foot and deeper than four inches in which no reinforcement is encountered; (3) for holes larger than 1/2 of one square foot where reinforcement is exposed. Concrete used for replacement shall be of the same strength and mixture as used in the structure except for color matching as specified above.

3. Use mortar replacement for holes too wide to dry-pack and too shallow for concrete replacement and when approved by OWNER for other conditions not covered above.

H. Cure all repairs with the same methods as new concrete.

3.6 CONCRETE FINISHES AND TOLERANCE

A. General Finish:

1. Working on unformed surfaces in various finishing operations shall be held to the minimum required to produce the desired finish. Use of any finishing tool in areas where water has accumulated will not be allowed. Work in these areas shall be delayed until the water has been absorbed, has evaporated, or has been removed by draining, mopping, dragging off with a loop of hose, or by other means. In no case, shall cement or mixture of cement and sand be spread on the surface to absorb excess moisture nor shall such materials or water be added to facilitate troweling. Joints and edges, unless specified otherwise, shall be carefully finished with edging tools.

2. Finishes for unformed surfaces shall be as designated below:

   a. Broom finish. Follow the treatment specified for finish U3 by roughening the surface immediately after troweling with a fiber bristle broom in a direction perpendicular to the direction of traffic. Broom grooves not more than 1/16 inch deep. After brooming, neatly tool all joints and edges to configuration.

B. Tolerances:

1. Unless otherwise required, allowable tolerances for concrete surfaces shall be in accordance with those shown in the table below. Surface irregularities are classified as either "abrupt" or "gradual". Offsets caused by displaced or misplaced form sheathing, lining, or form section or by defective form lumber shall be considered as abrupt irregularities. All others are classed as gradual irregularities. Gradual irregularities shall be measured with a template consisting of a straight edge for plane surfaces and its equivalent for curved surfaces.

2. The length of the template for unformed surfaces shall be 10 feet. Maintain a 10 foot length steel template on the job site.

3. Maximum allowable irregularities in concrete:

Finish	Irregularity in Inches	
Designation	Gradual	Abrupt
Broom Finish	1/8	1/8

3.7 UNSATISFACTORY CONCRETE

A. Any concrete placed which fails to meet or exceed the specified strength requirements as determined from molded cylinders or cores, or to meet the density or surface requirements, or which has been frozen during placing or curing, shall be removed and replaced with satisfactory materials at the CONTRACTOR's expense.

B. Method of determining unsatisfactory concrete: Visual appearance characteristic of rain or freeze damage to concrete which is apparent to the ENGINEER.

END OF SECTION

DIVISION 11

WATER TREATMENT SYSTEM

SECTION 11201

GROUNDWATER CIRCULATION WELL TREATMENT SYSTEM

PART 1 GENERAL

1.1 DESCRIPTION

A. Furnish all design and detail (to the extent not already defined in these Specifications and the Project Drawings), labor, materials, tools, equipment, and services for all Work as indicated in accordance with provisions of Contract Documents and industry standards.

B. It is neither the intent of the Specifications and Drawings to specify all technical requirements nor to set forth those requirements completely covered by applicable codes and standards.

C. Furnish and install all supplementary or miscellaneous items, appurtenances, and devices incidental to or necessary for a sound, secure and complete installation.

D. See General Specifications and Division 1 for additional requirements.

E. Coordinate with work of other trades and manufacturers.

F. Drawing S02 illustrates the basic treatment system that the OWNER requires. The Bidders may vary the system to suit their specific equipment, however the basic performance requirements must be met.

1.2 WORK INCLUDED

A. CONTRACTOR is responsible for the design, fabrication, procurement, delivery, erection, check out, start-up, and testing of all in-well and treatment equipment and miscellaneous components required for a complete and operable groundwater circulation well (GCW) treatment system.

B. CONTRACTOR is responsible for the procurement, delivery, installation, check out, and testing of all electrical controls and starters, and control wiring required for the treatment systems.

C. CONTRACTOR is responsible for the design, procurement, delivery, installation, check out, and testing of all electrical equipment and materials, including conduit, wire, disconnects, supports, mounting hardware and terminations, required to connect all treatment system equipment.

D. CONTRACTOR is responsible for the hookup of all utilities required by the system. Existing power and telephone service connections are at the SE Mather Road entrance, as shown on the Electrical Site Layout.

E. CONTRACTOR is responsible for the overall detailed design and shop drawings for the fabrication and installation of all vaults, equipment, trenching, equipment housing, and all other associated equipment.

F. Provide operating and maintenance manuals for all equipment installed, including a schedule of recommended service. Three (3) copies of each manual are required.

G. Provide all special tools required for installation, start-up, operation and maintenance.

1.3 SYSTEM DESCRIPTION

A. General

In general, the GCW technology consists of a specially constructed double screened well that can simultaneously mobilize and treat contaminants from the saturated zone. The GCW system creates a groundwater circulation cell that transports the dissolved and residual mobile-phase organic compounds to a central well casing for treatment. The treatment methodology is primarily air stripping for VOCs.

Vertical groundwater circulation in the saturated zone is established by creating a pressure differential (using a mechanical pump) across two screens in the treatment well. In a standard circulation mode, groundwater enters the well through the deep screen and leaves through the shallow screen. In a reverse circulation mode, groundwater enters the well through the shallow screen and leaves through the deep screen. The GCW units at this site will operate in reverse circulation mode. Between its travel within the casing from one screen to the other, groundwater passes through an in-situ treatment system, consisting of an air stripper/aerator. VOCs in the off-gases are usually processed in an above-ground granular activated carbon (GAC) unit. Biofilters or thermal oxidizers are used when appropriate.

The system is modified to operate under a closed loop for the gas phase so that stripping is done with minimum fresh air to maintain anaerobic conditions. Closed loop operation is helpful in reducing fouling due to metals precipitation and provides some noise reduction of the system. Under closed loop operation the outlet of the vapor treatment system is piped back to the inlet of the air stripper, resulting in no air emissions from the system.

An upgradient capture zone, and a downgradient release zone have been estimated for each GCW unit. Part of the groundwater flow entering the GCW is from the untreated groundwater captured upgradient. An equal portion of treated groundwater leaves the circulation cell through the downgradient release zone. The remaining portion of water entering the well is recirculated within the circulation cell around the remediation well. As the system operates over time, the concentrations of contaminants in groundwater may fluctuate initially due to soil flushing and mobilization, then decrease steadily until an asymptotic level is reached.

B. GCW Treatment System

The groundwater circulation well treatment system shall be generally constructed according to the schematic, Drawing S02**.** The CONTRACTOR will install an 10-inch diameter well casing to the appropriate depth and screened intervals as identified Drawing S03. Well installation methods and materials are discussed in Section 02671. Within the 10-inch diameter well, an inflatable well packer and effluent pipe shall be placed a minimum of 2-feet above the lower screen section and 2-feet below the upper screen section, preventing the flow of water between the upper and lower section of the well. In addition to the packer and effluent pipe, a submersible pump and influent pipe will be installed below the bottom of the upper screen section, but above the well packer.

The well casing will terminate at the bottom of the subsurface vault, in which the treatment process will occur. Groundwater will be pumped from the upper screen of the well via the influent pump, through a flowmeter, into an air stripping unit contained within the vault. An influent sampling port will be located prior to the air stripping unit. In the in-situ air-stripping unit, the water will be contacted with air, which will cause the volatile compounds to be stripped from the water into the

exhaust air. The treated water will be pumped back down the effluent pipe, through the packer where it will discharge into the lower portion of the well and exit through the lower screen. An effluent sampling port will be provided prior to the treated water exiting the treatment vault. The influent and effluent submersible pumps shall be balanced such that the influent water volume equals the effluent volume. The air-stripping unit shall achieve a minimum removal efficiency of 95% for influent concentrations of 1.0 to 480 µg/l PCE, 1.6 to 330 µg/l TCE, and 1.0 to 400 µg/l VC. Influent concentrations are based on the remedial goal and the maximum measured values from the October 2002 groundwater sampling event. Removal efficiency shall be measured by sampling the influent and effluent PCE, TCE, and VC concentrations after the groundwater completes a single pass through the unit.

The air stripper unit will be connected to the vacuum side of a blower. Air will flow through the air-stripping unit, passing through the contaminated groundwater. The air containing the volatile compounds will then pass through a water knockout tank to the blower, and then to a vapor treatment system. The vapor treatment system will consist of two granular activated carbon vessels followed by a zeolite vessel for the destruction of vinyl chloride. Exhaust from the gas treatment system will return to the inlet of the air stripper unit. There will be no allowable emissions from the vapor treatment unit since the system will be operated in closed-loop fashion. All equipment shall be enclosed in either the underground vault or an above-ground weather- proof enclosure of the CONTRACTOR's design.

Some scaling and biofouling of the discharge screen is anticipated. In order to reduce the potential for scaling and biofouling, the following items shall be taken into account in the CONTRACTOR's design.

- Closed loop, air line operation – reduces the amount of oxygen introduced to the system, reducing scaling potential due to oxidation.
- Biocide addition – addition of biocide prior to re-injection of treated water, reducing biofouling potential. The biocide dosing system is an optional feature that may be required at a future date. The treatment system shall be designed to be easily retrofitted with the biocide dosing system. Documentation showing specific retrofit upgrade options shall be provided by the CONTRACTOR prior to commencement of on-site work.

The treatment system shall have a remote control panel which houses the variable frequency drive controllers for the submersible pumps, flow meter displays, and "Manual/Auto/Off" switches for both the blower and pumps. The control panel shall also house the alarm condition relays and autodialer. The alarm conditions for the system shall be a high water level alarm in the subsurface vault, high water level alarm in the knockout tank, shutdown of the influent submersible pump, shutdown of the effluent submersible pump and shutdown of the blower. The high water level alarm shall indicate when the effluent pump is unable to maintain water levels within the vault. The influent and effluent pumps shall be equipped with a Variable Frequency Drive (VFD) control that is capable of transmitting a signal when the pump shuts down. Any of the five alarm conditions shall shut down power to the blower and submersible pumps (including the optional biocide pump). The control system shall also trigger the autodialer to send a "maintenance required" page when any of the five alarm conditions occur. The system shall not have an automatic restart when alarm conditions occur. The control panel shall have a manual alarm reset button, which will allow the operator to restart the system.

The system shall be designed to operate initially in the reverse circulation mode, but shall have the flexibility to operate in the standard circulation mode described in Section 1.3.A. Mechanical pumps are required for the system, an air lift system is not desired and will not be considered. Transducer controls for the variable frequency drives of the pumps are not desired and will not be considered.

The systems on the ODOT property shall be designed to reduce the noise generated by the systems to not exceed 65 dBA as measured at the window of the nearest office. All systems shall be designed to reduce noise generated by the systems to not exceed the Clackamas County Noise Ordnance level of 50 dBA as measured at the door or window of the nearest noise sensitive unit during the hours of 10 PM to 7 AM. It is approximately 1500 ft to the nearest residence from the property line.

The equipment enclosures shall each be lighted and contain a standard 110-volt receptacle for the servicing of equipment.

1.4 QUALITY ASSURANCE

A. All design, materials, fabrication, equipment, construction, and the responsibility of inspection, start-up, and testing shall be by the CONTRACTOR and shall comply with all applicable federal, state and local statutes in addition to the regulations, specifications, standards and requirements in effect at the date of contract.

B. In the event of any apparent conflict among standards, codes, or the Specifications the most stringent shall take precedence. The CONTRACTOR shall refer the conflict to the ENGINEER for written resolution.

C. The in-situ air stripper and related accessories shall be designed and fabricated by an equipment manufacturer who has regularly engaged in the design and manufacture of groundwater treatment system equipment for a period of not less than five (5) years.

D. The electrical construction, erection, installation and connection shall comply with the National Electrical Code (NEC) and Division 16 of these Specifications.

1.5 PROJECT DRAWINGS AND INFORMATION

A. Drawings are partially diagrammatic for purposes of clarity and legibility, and indicate general arrangement of systems and equipment, except when specifically dimensioned. However, the CONTRACTOR shall be responsible for verification of dimensions and production of as-built drawings.

B. Drawings are intended to show location and relationship of equipment. Every attempt has been made in preparation of the layout to allow installation of equipment as typically sized by industry practice for similar processes.

C. The CONTRACTOR will be responsible for final layout dimensions and details to incorporate the selected equipment into the treatment system. The CONTRACTOR shall adhere to the overall layout and intent of the drawings.

1.6 SUBMITTALS

A. Bid Package

1. Bid submittal shall include all calculations performed by the CONTRACTOR (or CONTRACTOR's vendor) necessary to verify air-stripping removal efficiency. The CONTRACTOR shall also provide a description of the methods used in the calculations, which also describes any calculation not included because it is considered a trade-secret.

2. Bid submittal shall also include pump curves and blower curves necessary to verify the air to water ratio achieved by the proposed stripping system.

3. Bid submittal shall include a conceptual equipment layout for each equipment enclosure, and a typical well vault construction. The conceptual layout shall show the approximate footprint of equipment within the enclosures. Conceptual layout shall also identify any system components the CONTRACTOR intends to combine within equipment enclosures that contain multiple systems, if any. The conceptual layout shall also identify the intended manufacturer and model of air stripper to be used, along with approximate dimensions of unit.

B. Drawings and Technical Data Submittals

1. Final equipment layouts for all GCW systems including equipment list identifying all treatment system components. Equipment list and technical data shall include manufacturer, make and model number, capacities, materials of construction, etc. Submit for OWNER approval withing three (3) weeks after Notice to Proceed.

2. Flow diagrams and control logic including electrical and mechanical schematics and system description. Submit for OWNER approval withing three (3) weeks after Notice to Proceed.

3. Electrical diagrams including internal/external wiring schematics, layout drawings showing location of all devices, control panel layout drawings, and interconnecting cables. Submit for OWNER approval withing three (3) weeks after Notice to Proceed.

4. Fabrication and delivery schedule including schedule of review and approval drawing submittals. Submit for OWNER approval withing three (3) weeks after Notice to Proceed.

5. List of spare parts and recommended on-hand spare parts for one (1) year of operation and current price of each. Submit for OWNER approval prior to installation of any equipment.

6. Operations and Maintenance manuals for all equipment. Three (3) copies of each manual are required. Submit for OWNER approval prior to operation of systems.

C. Shop drawings.

D. Recommend lubricants and quantities.

E. Component Warranties.

F. Operation Submittals.

1. Operation submittals shall be provided to the ENGINEER and OWNER on a monthly basis during the long-term operation period discussed in 3.9.
2. Inspection Log – Log shall include, at a minimum, date of inspection, air and water flowrates, pressure readings at carbon and zeolite vessels, vacuum reading at stripper, and comments.
3. Maintenance Checklist – Checklist shall show when scheduled maintenance occurred, and shall also record any other maintenance or repair work that was performed on the systems and person(s) performing work.

4. Performance Log – Log for each system showing all system shutdowns and startups, time and date of each for the month. The monthly percent downtime shall be calculated on the log for the 3 month rolling period. OWNER shall approve calculation of downtime or return for correction by CONTRACTOR.
5. Monthly Summary – Summary shall further elaborate on any operational issues encountered during the month and the resolution of these issues. The summary shall also detail any warranty work performed on the system.

1.7 ALTERNATES/ALTERNATIVES

A. These Specifications have been written with the intent to procure high quality equipment. It is not the intent to specify all details of design and construction; therefore, equipment shall be fabricated and equipped with accessories in accordance with the vendor's standard practices when such practices do not conflict with these Specifications. Deviation of the manufacturer's equipment from the requirements set forth in these Specifications will be evaluated and must be approved by the OWNER.

B. Any deviation from the design contained in these Specifications and Drawings should be well documented in the bid documents.

PART 2 EQUIPMENT

2.1 ACCEPTABLE MANUFACTURERS

A. All equipment shall be purchased from or fabricated by manufacturers normally engaged in water handling, treatment of contaminated water, air handling, and vapor treatment. Evidence of fabrication of groundwater circulation well systems utilizing in-situ air stripping on similar projects shall be provided and will be considered in the evaluation.

2.2 MATERIALS

A. All materials shall be heavy duty, specifically for outdoor use. Materials shall be appropriate for use with water or vapors containing chlorinated solvents.

2.3 SUBMERSIBLE PUMP

A. General Design

1. The pump shall be of heavy duty, stainless steel construction.

2. The pump shall be able to pump across the following ranges

a. 10 to 25 gallons per minute (GPM) at GCW-2 and GCW-3.
b. 5 to 15 GPM all others.

3. The pump shall be equipped with protection against burning out due to dry pumping. The protection shall be able to be manually reset when the system is inspected in the field.

4. The variable speed controller shall be a remote unit contained in the system control panel.

5. The VFD shall be capable of communicating the shutdown of the pump to the control panel.

6. CONTRACTOR shall provide one R100 remote unit for control and display of VFD at each equipment enclosure.

7. Submersible pump, VFD controller, and R100 remote unit shall be an SQE model by Grundfos or approved equal.

2.4 IN-SITU AIR STRIPPING UNIT

A. General Design

1. The unit shall be of heavy duty, high-density polyethylene (HDPE) construction, or other appropriate heavy duty material.

2. The unit shall provide a minimum removal efficiency of 95% for influent concentrations of 1.0 to 480 µg/l PCE, 1.6 to 330 µg/l TCE, and 1.0 to 400 µg/l VC. This removal efficiency shall be measured for a single pass through the air-stripper unit.

3. The unit shall be designed to fit within the subsurface vault.

4. The unit shall be designed to minimize fouling and maintenance.

5. The air stripper shall be a vacuum operated unit.

6. The air stripper shall be equipped with a port to measure the internal pressure with a standard pressure gauge, to verify vacuum operation.

2.5 PACKER

A. General Design

1. The packer shall be of heavy duty construction with a stainless steel 2" core pipe with an inflatable gland of material suitable to withstand site contaminants.

2. The packer shall have an inflatable gland which, when pressurized, will expand within the well casing, preventing the migration of water past the packer.

3. The packer gland shall be able to withstand an internal pressure of up to 100 psi.

4. The packer shall be able to withstand a differential pressure of 50 psi.

5. The packer shall include an inflation kit which will be left in-place after installation to allow proper maintenance of the packer and monitoring of air pressure.

6. The packer shall provide a properly sized connection for the effluent pipe, allowing water from the effluent pipe to pass vertically through the packer. The underside of the packer shall also have a properly sized connection for a pump cable (to allow for standard GCW flow configuration).

7. The Packer shall have a gas vent line running to the well vault to a valve, which will be normally closed. The vent line shall allow gas buildup below the packer in the well casing to be purged.

8. The packer shall be able to support itself and the in-well assembly within the well when inflated.

9. All packers shall be leak tested in a piece of blank 10" casing prior to installation in the well.

2.6 BLOWER

A. General Design

1. The blower shall be of heavy duty construction.

2. The blower shall be a centrifugal type blower.

3. The blower shall be sized appropriately by CONTRACTOR to achieve the 95% removal efficiency required for the system.

4. The air flow rate shall be adjustable.

5. The air flow rate through the blower shall be measurable.

2.7 LIQUID KNOCKOUT TANK

A. General Design

1. The knockout tank shall be of heavy duty construction.

2. The knockout tank shall have an interior lining which is resistant to corrosion by contaminated water.

3. The knockout tank shall have a minimum volume of 10 gallons.

4. The knockout tank shall be equiped with a site tube to allow monitoring of the water level inside the tank.

5. The knockout tank shall be equipped with a high water level sensor which will shutdown the blower and submersible pumps if activated.

6. The knockout tank shall be equipped with a drain valve at the bottom of the tank.

7. The knockout tank shall be protected from freezing with electrical heat tape.

8. The knockout tank shall be equipped with a vacuum relief valve to prevent damage to the system in the event of excessive vacuum generation.

2.8 VAPOR TREATMENT UNIT

A. General Design

1. The vapor treatment unit shall be of heavy duty construction, for outdoor use.

2. The vapor treatment system will consist of two granular activated carbon vessels followed by a zeolite vessel, containing zeolite and a permanganate media for the destruction of vinyl

chloride. The number of carbon and zeolite vessels may be increased to account for multiple wells as necessary.

3. The zeolite shall be Hydrosil HS-600 with XB-17 media, or approved equal. Hydrosil is out of Elgin, IL

4. There are no allowable emissions from the treatment system at this time, since it is to be operated under a closed-loop setup.

5. The unit shall be designed to allow access for maintenance, and media regeneration or replacement as necessary.

6. As the CONTRACTOR's design may have a varying number of vapor treatment vessels, depending on number or wells and concentration, the CONTRACTOR shall provide vapor sampling ports at the following locations:

- Prior to the inlet to the first carbon vessel.
- Immediately before the last carbon vessel.
- After the last carbon vessel.
- Immediately before the last zeolite vessel.
- Immediately after the zeolite vessel.

6. Sampling port locations may be combined as appropriate.

10. Sampling port locations shall be approved by the OWNER prior to installation.

2.9 SUBSURFACE VAULT

A. General Design

1. The vault shall be of heavy duty, molded HDPE construction, or of another waterproof, VOC resistant, heavy duty material, as approved by OWNER.

2. The vault lid shall fit into the body forming an water-tight seal and prevent debris from entering the vault.

3. The penetration through the vault for the GCW well casing shall be sealed to prevent water seepage.

4. The vault shall be installed and surrounding ground shall be graded so that water drains away from the vault.

5. Penetrations through the vault body or lid shall be sealed to protect equipment from debris.

6. The bottom of the vault shall be installed no more than 4' below the capped surface of the site.

2.10 PIPING

A. All piping internal to the system including the influent and effluent pipes shall be SDR 11 HDPE pipe.

B. The effluent line, returning water back into the well after treatment, shall have a pressure guage connection, with a liquid phase pressure gauge reading 0-25 psi.

2.11 FLOWMETER

A. General Design

1. The flowmeter shall be of heavy duty construction.

2. The flowmeter shall have an in-line sensing unit, with a remote display unit.

3. The display unit shall be contained in the system control panel.

4. The display unit shall display a totalized value and an instantaneous reading in gallons per min.

2.12 EQUIPMENT ENCLOSURE

A. The equipment enclosures shall be a Tuff Shed, Builders Series, Ranch Style shed or approved equal.

B. The equipment enclosure shall be sized by the CONTRACTOR so that all of the equipment can be accessed and serviced.

C. The CONTRACTOR shall submit color samples of available colors from which the OWNER will choose the shed finish color.

D. Equipment enclosures shall not exceed 120 square feet. If equipment enclosure exceeds 120 square feet, CONTRACTOR shall design the structure according to the most recent Oregon Building Code and Clackamas County requirements, and obtain all necessary building permits required by the Clackamas County Building Department.

E. Placement of the equipment sheds shall be in compliance with the 20-foot front setback required by Clackamas County.

F. The equipment enclosure shall have adequate lighting for servicing equipment.

G. The equipment enclosure shall be properly ventilated for the operation of the equipment.

H. The equipment enclosure shall have signage clearly indicating the following contact information:

- Emergency Contact: EPA Emergency Response (206) 553-1263.
- Site Identification: Northwest Pipe & Casing Superfund Site.

I. The equipment enclosure shall have industry standard signage indicating the following:

- No Trespassing.
- Electrical Hazard.
- Hearing Protection Required.
- Eye Protection Required.

J. Proposed signs for all equipment enclosure signage shall be approved by OWNER prior to placement.

2.13 CONTROL PANEL

A. General Design
Includes external main disconnect, motor circuit fuses and magnetic starter with thermal overload relay for each motor, on/off or hand/off/auto selector switch for each motor, alarm indication lights for each field alarm switch, and paging system. The control panel shall also house flowmeter displays and VFD control boxes for the submersible pumps. The panel shall be mounted in the equipment enclosure and rated NEMA 4. The control panel will monitor and control the operation of the GCW Treatment System.

B. Alarm Conditions
The system shall shut down the blower, both submersible pumps, and optional biocide pump, then send a "maintenance required" page when any of the following conditions occur:

1) Blower shutdown
2) High water level in vault
3) Influent submersible pump shutdown
4) Effluent submersible pump shutdown
5) High water level in knockout tank

C. Paging System
The treatment system shall include an autodialer that is preprogrammed to send a "maintenance required" page that also identifies the individual system, so that maintenance can be dispatched when the system shuts down. The autodialer shall be capable of being reprogrammed in the field.

PART 3 EXECUTION

3.1 INSPECTION

A. The CONTRACTOR shall verify the location and elevation of all wells and obstructions prior to shipping equipment to job site.

3.2 DELIVERY, STORAGE AND HANDLING

A. CONTRACTOR is responsible for delivery to and receipt, on site, of all materials.

B. Provide shipping protection and on-site storage protection for all materials.

C. Provide covered and heated storage as necessary for materials which are not designed for outdoor or unprotected installation.

D. Repair, restore and replace items damaged in shipping, handling and installation.

3.3 INSTALLATION

A. Installation shall be in a workmanlike manner and to standard industry practice.

B. Provide all labor and supervision necessary for complete installation and start-up of all equipment and accessories.

C. Furnish all tools, welding equipment, cranes, consumable supplies, etc.

D. Mechanical installation shall include, but is not limited to, alignment, shimming, and tracking of belts, drives, equipment, etc., in accordance to the manufacturer's recommendations and general practice.

E. Provide touch-up painting of all field joints and damage for all new equipment.

F. Flush all hydraulic systems and piping of foreign materials and weld slag.

G. Installation of vendor fabricated equipment shall be in accordance with the vendor's recommendation.

H. CONTRACTOR shall be responsible for repair or correction of errors due to design or manufacture.

3.4 QUALITY CONTROL AND TESTING

A. Shop Tests

1. At a minimum, one air-stripper unit shall be assembled and operated to evidence correct function prior to shipment.

2. All control panels shall be assembled and operated to evidence correct function prior to shipment.

2. CONTRACTOR shall notify ENGINEER two weeks prior to tests to allow ENGINEER the option to witness tests.

B. Field Tests

1. All shop and field assembled equipment shall be operated as a system to verify correct function in all operating modes.

2. CONTRACTOR to provide all labor for check-out and start-up of equipment.

C. Field Inspection

1. The CONTRACTOR and ENGINEER will conduct a walk-through to inspect for soundness and completion of installation.

2. Inspection will include connections, welds, finish painting, alignments, guards, access, etc.

3. Inspection will verify proper clean-up equipment for removal of foreign material and construction wastes.

4. CONTRACTOR shall develop and keep up-to-date an alignment and check-out log for all equipment.

3.5 SHOP ASSEMBLY

A. All critical dimensions shall be verified and checked for fit and matchmarked prior to shipping.

B. Finishes

1. Manufacturer's standard primer and finish coat of paint on prefinished motors, gear boxes, etc.

C. Equipment shall be shipped in as large a sub-assembly as can be legally transported or readily handled.

D. Nameplates shall be provided on all motors, gear boxes, pumps, and other equipment providing the following information:

1. Manufacturer

2. Size, capacity, speed, etc.

3. Model number

4. Serial number

5. Other pertinent data

3.6 SHAKEDOWN

A. After installation, the CONTRACTOR shall conduct a shakedown of the system. Shakedown procedures and a schedule shall be presented to the OWNER for approval.

B. The shakedown period is the CONTRACTOR's opportunity to test the system and correct any deficiencies found, prior to performance of the start-up and acceptance tests. The CONTRACTOR shall be responsible for operation of the system during this period.

C. CONTRACTOR shall be responsible for all maintenance and repairs of the water treatment system during this period.

D. The initial shakedown period shall not exceed two (2) calendar weeks from the time the OWNER approves the shakedown procedures. Final shakedown shall be implemented by the CONTRACTOR, and will consist of a two (2) week period in which all systems must be fully functional and operating with less than 10 hours of downtime.

E. CONTRACTOR shall determine the maximum flowrate for which pumping equilibrium can be achieved and maintained. Pumping equilibrium shall be assessed by observing that dry pumping in the influent or effluent pump is not occurring. The maximum equilibrium flowrate may be the maximum capacity of the pumps installed.

3.7 START-UP AND ACCEPTANCE TESTING

A. CONTRACTOR shall indicate in writing to the OWNER that the shakedown is complete and that the system is ready for acceptance testing. All permanent system components must be in place before requesting the acceptance test. Any exceptions to this requirement are contingent upon the prior approval of the OWNER. The CONTRACTOR shall conduct the acceptance test of the system. Results of the test shall be provided to the OWNER to determine whether it meets the specifications contained herein. CONTRACTOR shall be responsible for providing the equipment operators for the test. The OWNER reserves the right to determine the specific date and time of the test. Acceptance is defined as compliance with the technical specifications, and demonstration of the ability to achieve the minimum contaminant removal requirements contained in Section 2.4. Generally, the CONTRACTOR will conduct the test using the following guidelines:

1. Process groundwater at equilibrium conditions at the maximum flowrate determined in Section 3.6.E. for a minimum of two (2) consecutive days, with less than 2% downtime.

2. The OWNER shall conduct a visual inspection of the system prior to, and at the conclusion of the testing with the CONTRACTOR, noting any obvious leaks, equipment failures/ damage or abnormal wear and tear, as determined at the sole discretion of the OWNER. CONTRACTOR shall repair such leaks, damage or wear as a precondition to both the acceptance test and final payment if test parameters in Items 1 are successfully accomplished.

3.8 MAINTENANCE

A. CONTRACTOR shall describe routine, periodic, and annual maintenance requirements for the system, the number of hours per year for each level, and the intervals at which each level is required (i.e., daily, weekly, etc.). CONTRACTOR shall indicate which maintenance requirements should be performed by parties other than the OWNER, including the replacement/repair of system components. This information shall be provided in a System Operation and Maintenance Manual.

B. The CONTRACTOR shall be responsible for all maintenance and repair costs to the system prior to acceptance by the OWNER. CONTRACTOR shall thoroughly train OWNER personnel in routine, periodic and annual maintenance procedures to the satisfaction of the OWNER.

3.9 OPERATION, TRAINING, AND MANUALS

A. CONTRACTOR shall operate the systems for a period of one (1) year, with the option for the OWNER to extend the operation agreement with the CONTRACTOR.

1. CONTRACTOR shall limit downtime on a monthly basis to:

a. 1 day for standard maintenance procedures
b. 2 days for unplanned downtime

2. Downtime shall be assessed on a rolling three (3) month average.

B. CONTRACTOR shall operate the system at a flowrate determined by the OWNER, based on operational range of pumps and maximum equilibrium flowrate determined in Section 3.6.E.

C. CONTRACTOR is responsible for all operation, maintenance, and repair (per manufacturer warranties and CONTRACTOR system warranty) during the one (1) year operation period.

D. The one (1) year operation period is to begin after acceptance of the system by OWNER.

E. During the one (1) year operation period, CONTRACTOR shall submit monthly operation submittals as identified in Section 1.6.F.

F. During the last thirty (30) days of the operation of the system by the CONTRACTOR, the CONTRACTOR will thoroughly train the OWNER's appointed operators in the operation and maintenance of the systems and the individual components.

G. CONTRACTOR shall provide three (3) sets of operation and maintenance manuals, which include design calculations, pump curves, and blower curves. CONTRACTOR shall provide three (3) sets of as-built drawings of the equipment in sufficient detail to identify all components of the system.

3.10 WARRANTY

A. The CONTRACTOR shall provide a one (1) year warranty for all system equipment against defects in installation or operation. This warranty shall be in addition to the standard manufacturer warranty accompanying each piece of equipment.

B. The warranty period shall begin after acceptance of the systems by OWNER.

C. The system warranty shall also guarantee the performance of the system over the operation period. System performance will be assessed by OWNER through water influent and effluent samples, vapor samples, and operation log (i.e. downtime). CONTRACTOR shall provide all parts and labor required for the systems to meet the minimum operating requirements outlined in these Specifications.

END OF SECTION

DIVISION 15

MECHANICAL

SECTION 15010

GENERAL MECHANICAL REQUIREMENTS

PART 1 GENERAL

1.1 DESCRIPTION

A. This specification covers the requirements for handling, storage, installation, testing and field assembly of such items as the individual system components, shed or enclosure, tanks, fabricated items and other mechanical equipment.

1.2 RELATED WORK

A. DIVISION 1 – GENERAL REQUIREMENTS
B. DIVISION 2 – SITE WORK
C. DIVISION 3 – CONCRETE
D. DIVISION 11 – WATER TREATMENT SYSTEMS
E. DIVISION 16 – ELECTRICAL

1.3 QUALITY CONTROL

A. Provide per provisions of Section 01400.

B. Use skilled workmen who are thoroughly trained and experienced in construction with and installation of equipment specified in this section and who are completely familiar with the Drawing and Specification requirements and methods required for proper performance of the work of this and related sections.

C. The CONTRACTOR shall provide demonstrated approval of equipment items by the appropriate testing laboratory, i.e., Underwriter's Laboratories, Inc., etc., or the governmental agency, and/or engineering or manufacturing society or association.

D. The installing CONTRACTOR shall have those codes and standards that apply to this equipment item in the field office available for reference at all times during the construction.

E. Codes and standards referred to herein are to be used to establish a minimum standard of practice. Wherever Drawings and Specification requirements are in excess of code requirements, Drawings and Specifications shall govern.

1.4 GENERAL REQUIREMENTS

A. Handling and installation of the equipment shall be subject to approval by OWNER.

B. The CONTRACTOR shall be responsible for unloading equipment from the common carrier, removing equipment from its shipping containers, proper storage and preparing equipment for installation.

C. The CONTRACTOR shall inspect all equipment to ascertain that there is no visible damage, that sizes, model numbers and dimensions are as specified in the engineering data and that all parts are received as noted in packing lists. The CONTRACTOR shall be responsible for material control and expediting as required by the construction schedule.

D. The CONTRACTOR shall provide protection against deterioration, rust, damage, and theft of all equipment held in open storage prior to installation or exposed to weather or adverse conditions after installation, and the CONTRACTOR shall install and remove temporary screens or covers required to prevent entrance of injurious material or damage to the mechanical equipment.

E. The CONTRACTOR shall furnish all tools, chains, jacks, levels, straightedges, micrometers, shims, wedges and other such items required for proper handling and alignment of mechanical equipment.

F. When altering, in any way, a permanent structure in order to facilitate installation of the equipment covered herein, the CONTRACTOR, prior to executing such alteration, shall submit to OWNER for approval a detailed written request for such alteration.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Supply all new, unused materials and equipment as specified elsewhere in these Specifications or Drawings or OWNER furnished materials and equipment.

PART 3 EXECUTION

3.1 INSTALLATION PREPARATION

A. Prior to installing mechanical equipment, the CONTRACTOR shall check equipment arrangement and dimensions with the manufacturer's Drawings, and the CONTRACTOR shall check space allotment, foundations, piping configuration, and other like items, to ascertain that there are no interferences. The CONTRACTOR shall notify ENGINEER and OWNER regarding any discrepancies or installation difficulties disclosed. Additional costs incurred by the CONTRACTOR'S failure to report such discrepancies shall be borne by the CONTRACTOR.

B. Before placement of equipment, the CONTRACTOR shall check pipe sleeves through concrete slab, and concrete embedded items and anchor bolts, and where severe misalignments occur, adjustment of such misalignments shall be subject to the approval of OWNER.

C. Any deviation from the Drawings shall be subject to prior written approval of OWNER.

D. Where grout is required, the affected surface areas of supporting concrete shall be roughened or chipped as necessary, prior to positioning the equipment for installation. Dust shall be removed from the roughened surfaces (preferably by suction), and the surface scrubbed with water and fiber brushes until the water in the depressions remains clear. The concrete thus prepared shall be thoroughly wetted immediately prior to grout application.

E. Equipment surfaces that will be in contact with grout shall be thoroughly cleaned to remove oil or grease.

F. The CONTRACTOR shall remove all grease and other protective coatings applied to the equipment for protection in shipment. For such purposes, the CONTRACTOR shall use only those cleaners and methods not harmful to the surface finishes of the equipment.

3.2 INSTALLATION

A. The CONTRACTOR shall install equipment in strict accordance with the manufacturer's drawings, tolerances, instructions and recommendations.

B. When necessary, services of manufacturers' representatives, engineers or installers will be made available for installing mechanical equipment. Such services shall be requested by the CONTRACTOR sufficiently in advance to allow ample time for approval and procurement. Additional costs incurred by the CONTRACTOR'S failure to properly schedule such services shall be borne by the CONTRACTOR.

C. The CONTRACTOR shall position the equipment, shim to level, properly align components and tighten anchors. Prior to assembling equipment components or connecting external piping, ducts, and other like items, the CONTRACTOR shall thoroughly inspect the equipment internally for damage or defects, remove foreign materials, shipping seals and clean piping assemblies.

D. After completing external connections to piping and other like items, the CONTRACTOR shall ensure that equipment alignment is within the stated tolerances and that stresses from external connections do not exceed equipment manufacturer's limits.

E. Equipment requiring grouting shall be positioned, aligned and checked as described above, but grout shall not be applied until approved by OWNER.

F. Immediately prior to grout application, the CONTRACTOR shall clear the affected concrete surfaces of standing water and re-clean if necessary.

G. During grout application, the CONTRACTOR shall discontinue operation of nearby machinery which might fracture the grout during its initial set.

H. The CONTRACTOR shall use a nonmetallic, non-shrink, pourable grout for installing all grouted equipment. The CONTRACTOR shall use each grouting material in accordance with the grout manufacturer's instructions.

I. When the grout has cured, the CONTRACTOR shall recheck equipment alignment, adjust as required and retighten the anchor nuts. Use double nuts for all vibrating equipment.

J. Following final alignment and anchor tightening, the CONTRACTOR shall dowel the equipment where indicated by the manufacturer's drawings, as required, or as specified by OWNER.

K. The CONTRACTOR shall lubricate all equipment in accordance with the manufacturer's instructions and in keeping with acceptable engineering practice. The CONTRACTOR shall flush clean all equipment components requiring lubricant but shipped "dry." The CONTRACTOR shall completely flush oil supply and return piping, drain the flushings, clean the oil reservoirs, add the specified lubricant and purge the supply piping prior to connecting to the equipment.

L. The CONTRACTOR shall be responsible for subsystem assemblage to equipment requiring field assembly.

M. The CONTRACTOR shall install machinery guards provided by the equipment manufacturer, guards shown on engineering drawings, or as specified by OWNER. The CONTRACTOR shall check installed guards for firm mounting to ensure that proper clearances are maintained, and that access for lubrication, revolution counter, maintenance, and other like items are properly positioned.

N. The CONTRACTOR shall firmly attach plate fabricated equipment items to supporting members and shim and stiffen as required to relieve undue stresses and vibration. The CONTRACTOR shall install all gaskets where required and as indicated by engineering and vendor drawings. All welding shall be performed by personnel qualified for the class of work to which they are assigned.

O. Before operating mechanical equipment, the CONTRACTOR shall remove all construction debris in the area of the equipment, check the equipment for interferences, foreign materials and excessive stresses, check moving elements for proper freedom of movement, direction of rotation and other like operations and make adjustments as required by codes or specifications.

3.3 TESTING

A. All testing and commissioning shall be performed in accordance with specifications or as directed by OWNER.

3.4 FIELD TOUCHUP PAINTING

A. The CONTRACTOR shall touch up chips and scratches in painted surfaces of mechanical equipment with paint matching the original manufacturer's paint type and color as nearly as possible. Chips and scratches in the painted surfaces of field-fabricated steel shall also be touched up with matching paint by the CONTRACTOR.

END OF SECTION

SECTION 15051

SYSTEM PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SCOPE OF WORK

A. Construction of Groundwater Circulation Well (GCW), installation of GCW components, and installation of Groundwater Treatment System components.

B. Installation of piping and electrical connections between the GCW and the Equipment Enclosure.

C. Installation of electrical and communication conduits from the Equipment Enclosure to the site electrical service.

D. Installation of the submersible pump, inflatable packer and other in-well components in the GCW.

E. Construction of Groundwater Monitoring Wells.

F. Connecting electrical supply to the combined treatment system.

G. Start up and testing of the treatment system.

1.2 RELATED WORK

A. Section 01300 - Submittals

B. Section 01400 - Quality Control

C. DIVISION 1 - GENERAL REQUIREMENTS

D. DIVISION 2 – SITE WORK

E. DIVISION 3 - CONCRETE

F. DIVISION 16 - ELECTRICAL

1.3 REFERENCES

A. Uniform Plumbing Code, 1988 Edition

B. ANSI B16.3 - Malleable Iron Threaded Fittings Class 150NS300

C. ANSI/AWS D1.1 - Structural Welding Code

D. ASME B16.18 – Cast Copper Alloy Solder Joint Pressure Fittings

E. ASME B16.22 – Wrought Copper and Bronze Solder Joint Pressure Fittings

F. ASTM A120 - Pipe, Steel, Black and Hot-Dipped Zinc Coated (Galvanized), Welded and Seamless

G. ASTM A197 - Specification for Cupola Malleable Iron

H. ASTM A234 - Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures

I. ASTM B32 – Solder Metal

J. ASTM B88 – Seamless Copper Water Tube

K. ASTM D1784 - Specification for Rigid Poly Vinyl Chloride (PVC) Compounds and Chlorinated Poly Vinyl Chloride (CPVC) Compounds

L. ASTM D1785 - Specification for Poly Vinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, and 120

M. ASTM D1598 - Test Method for Time-to-Failure of Plastic Pipe Under Constant Internal Pressure

N. ASTM D2241 - Specification for Poly Vinyl Chloride (PVC) Pressure-Rated Pipe (SDR Series)

O. ASTM D2464 - Specification for Threaded Poly Vinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 80

P. ASTM D2466 - Specification for Poly Vinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 40

Q. ASTM D2467 - Specification for Poly Vinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 80

R. ASTM D2665 - Poly Vinyl Chloride (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings

S. ASTM D2855 – Making Solvent-Cemented Joints with Poly Vinyl Chloride (PVC) Pipe and Fittings

T. ASTM F493 – Solvent Cements for Chlorinated Poly Vinyl Chloride (CPVC) Plastic Pipe and Fittings

U. AWWA C200 - Steel Water Pipe 6 in. and Larger

V. AWWA C900 - AWWA Standard for Poly Vinyl Chloride (PVC) Pressure Pipe, 4 in. through 12 in., for Water

W. AWWA C905 - AWWA Standard for Poly Vinyl Chloride (PVC) Water Transmission Pipe, Nominal Diameters 14 in. through 36 in.

X. FS - Federal Specifications

1.4 QUALITY CONTROL

A. Provide per provisions of Section 01400.

B. Piping installations shall meet requirements of national, local, and state codes.

C. Supply all new materials free from defects.

D. Where no method of tests for materials is specified, the latest applicable test specified by ASTM shall be followed.

1.5 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Submit certified copies of test reports prior to system testing.

C. Submit product data for all equipment and their components, and the equipment control panel including use, operating range, total range, dimensional data, and location for manufactured components.

D. Submit manufacturer's installation and maintenance instructions.

E. Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturer's catalog information. Indicate valve data and ratings prior to installation.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and protect piping and equipment to site under provisions of Section 01600.

B. Exercise care in transporting and handling to avoid damage to pipe and equipment.

C. Keep materials clean, dry, and free from deleterious conditions.

D. Do not store material directly on the ground.

E. Repair or replace damaged pipe as approved by OWNER.

F. All equipment supplied shall be skid mounted and shipped assembled in the enclosure to the greatest extent possible, consistent with handling and shipping limitations.

G. All equipment which is skid mounted shall be pre-piped in the shop to the greatest extent feasible.

H. Structural skid configuration shall preclude the use of diamond plating, or other unsuitable structural materials.

I. Prior to shipment, all flanges, openings and nozzles shall be adequately protected to prevent damage, corrosion or contamination from foreign matter. The method of sealing used shall not endanger threaded parts, weld preparations or flange faces.

J. Prior to shipment, all pre-assembled units and equipment components shall be disassembled only to the extent necessary to facilitate field handling and to prevent damage during shipment.

K. All equipment and small loose pieces, tools, gaskets, etc. shall be adequately packed to prevent damage or loss during shipment or while in storage. All crates shall be identified with the equipment piece numbers. Major equipment shall bear the appropriate tag.

L. Lifting lugs, eye bolts and other lifting aids shall remain in place on the equipment until the equipment is in final position. These lifting aids may be left in place at the OWNER's option.

M. All water shall be drained from the equipment prior to shipping.

PART 2 PRODUCTS

2.1 HIGH DENSITY POLYETHLENE (HDPE) PIPE AND FITTINGS

A. Pipe shall be Plexco HDPE SDR 11 or approved equivalent.

B. Electrofuse fittings shall be Central or approved equivalent.

C. All fittings shall be electrofusion or heat fusion type fittings, unless approved by OWNER.

2.2 POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

A. Pipe shall be Type 1, Grade 1, or Class 123454-B conforming to ASTM D1784 and ASTM D1785.

B. Fittings shall conform to ASTM D2464, ASTM D2466 or ASTM D2467.

C. Pipe and fittings placed above ground surface shall be Schedule 80 PVC.

D. Pipe and fittings placed below ground surface shall be Schedule 80 PVC.

E. Provisions for expansion shall be as recommended by the pipe manufacturer.

2.3 GALVANIZED STEEL PIPE (GS)

A. Galvanized steel pipe shall be Schedule 40, ASTM A 120, Grade A black with galvanized 150 pound malleable iron screwed fittings meeting ASTM A197 with dimensions conforming to ANSI B16.3. Unions shall be 300 pound galvanized malleable iron meeting ASTM A197, dimensions conforming to ANSI B16.9.

B. Fittings to be ASTM A234, forged steel welding type.

2.4 COPPER TUBING

A. Type: ASTM B88, Type L hard drawn.

B. Fittings: ASME B16.18, cast copper alloy, or ASME B16.22, wrought copper and bronze.

C. Joints: ASTM B32, solder, Grade 95TA.

2.5 PIPE SUPPORTS AND HANGERS

A. Hangers for Pipe Sizes 1/2 to 1-1/2 inch diameter: Carbon steel, adjustable swivel, split ring.

B. Hangers for Pipe Sizes 2 inches diameter and larger: Carbon steel, adjustable swivel, clevis.

C. Wall Support for Pipe Sizes to 3 inches diameter: Cast iron hook.

D. Wall Support for Pipe Sizes 4 inches diameter and larger: Welded steel bracket and wrought steel clamp; adjustable steel yoke and cast iron roll for hot pipe sizes 6 inches and over.

E. Vertical Support: Steel riser clamp.

F. Floor Support for All Pipe Sizes: Cast iron adjustable pipe saddle, locknut nipple, floor flange, and concrete pier or steel support.

G. Size sleeves large enough to allow for movement due to expansion and contraction. Sleeves to be Schedule 40 PVC.

H. Design hangers without disengagement of support pipe. Design hangers to avoid point loads on pipe.

PART 3 EXECUTION

3.1 INSTALLATION OF PIPE

A. Install pipe to line and elevations shown on the drawings prepared by the CONTRACTOR.

B. The CONTRACTOR shall take care to keep from damaging the pipe by heavy loads and unnecessary compactive effort especially for shallow lifts. All damaged pipe shall be replaced. Repairs will not be acceptable.

C. Prior to all work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.

D. Verify that all pipe may be installed in accordance with all pertinent codes and regulations, the original design, and the referenced standards.

E. Before new pipe is placed, the sub-grade material shall be graded so that pipe will rest firmly on granular materials for its full length. In general, this should be accomplished by over-excavation, adding stabilizing material as required, or the inclusion of imported bedding material. All adjustments to line and grade shall be made by scraping away or filling in the bedding to the body of the pipe and in no case by wedging or blocking. Pipe shall be laid on an unyielding foundation to proper line and grade with uniform bearing under the full length of the pipe with slight hand excavation to allow for the thickness of the coupling.

F. Support pipe as required during installation to prevent distortion of pipe before placing concrete or backfilling, or before completing permanent supports.

G. Run piping free from contact with structures or installed items.

H. Allow clearances for expansion and contraction of pipe.

I. Place vertical piping as follows:

1. Secure at sufficiently close intervals to keep pipe in alignment and to support the weight of the pipe and its contents.

2. Fabricate and install pipe supports as required to provide rigidity and stiffness.

3. If piping is to stand free of support, or if no structural element is available for support during construction, secure pipe in position with wooden stakes or with braces fastened to pipe.

J. Place horizontal piping as follows:

1. Support pipe at sufficiently close intervals to maintain alignment and prevent sagging, in accordance with manufacturer's recommendations.

2. Install hangers or supports at ends of runs or branches and at each change of direction or alignment. In addition, install a support for every valve 4-inch and larger.

3. For suspended pipe, support spacing shall not exceed manufacturer's recommendations, nor the following guidelines:

Diameter	Maximum Support Spacing (feet)
PVC Pipe	
Under 1½ inches	2
1½ to 4 inches	4
Over 4 inches	8
GS Pipe	
All	4

K. Install pipe so as not to induce strain on equipment during or subsequent to the installation of pipework.

L. Provide flexible connections, unions, couplings, hoses and valves in appropriate locations to facilitate removal for maintenance.

M. Pipe to be assembled in strict accordance with the manufacturer's specifications and the Uniform Plumbing Code.

N. Installation of pipe shall be performed when the ambient air temperature is between 40°F and 90°F.

O. Support pipe at intervals recommended by pipe manufacturer or as provided above, which ever is more stringent.

P. Paint or coat all exposed pipe as recommended by the manufacturer for protection from ultraviolet radiation.

3.2 INSTALLATION OF FLANGED PIPE

A. Tighten flange bolts in rotation so that gasket is uniformly compressed and sealed.

B. Do not distort flanges.

C. Leave flange bolts with ends projecting 1/8- to 3/8-inch beyond the face of nut after tightening.

3.3 INSTALLATION OF THREADED JOINT PIPE

A. Use threads that conform to ANSI B2.1, NPT.

B. Cut threads full and clean with sharp dies.

C. Ream ends of pipe after threading and before assembly to remove burrs.

D. Leave not more than two pipe threads exposed at each connection.

E. Seal joint with Teflon thread tape or graphite base pipe compound.

3.4 PIPE HANGERS AND SUPPORTS

A. Install hangers to provide minimum 1/2 inches space between finished covering and adjacent work.

B. Place a hanger within 12 inches of each horizontal elbow.

C. Use hangers with 1-1/2 inches minimum vertical adjustments.

D. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

E. Support riser piping independently of connected horizontal piping.

F. Provide templates, anchor bolt, and accessories for mounting and anchoring equipment.

G. Construct support of steel pipe and fittings. Brace and fasten with flanges bolted to structure.

H. Provide rigid anchors for pipes after vibration isolation components are installed.

3.5 INSTALLATION OF EQUIPMENT

A. Install all equipment in accordance with manufacturer instructions and procedures.

C. Level the base of all equipment.

3.6 CLEANING AND PROTECTION

A. Take precautions during fabrication and erection to prevent entrance of foreign matter into piping or equipment.

B. Remove dirt, oil, grease, or other foreign substances from interior surfaces of piping and equipment prior to connecting piping to equipment.

C. Prior to fabrication in shop or field, foreign materials present in the pipe shall be removed and all threaded and solvent welded joints shall be cleaned before connecting.

D. Cap or plug open ends of pipe spools after fabrication to keep out dirt and other materials until pipe spools are connected to equipment.

E. Clean and flush all completed piping to satisfaction of OWNER before final connection to equipment. After completion of any test, where non-potable solutions are used, all parts of installation shall be cleaned. Touch up painted or coated surfaces of pipes that have been chipped or scraped during installation.

3.7 TESTING

A. Pressure testing of the vapor lines will be performed by CONTRACTOR according to the appropriate ASTM method for the appropriate HDPE pipe size and expected operating conditions.

B. Furnish all materials, equipment, and labor for testing and re-testing the piping system.

C. Furnish all temporary pipe support required for a successful pressure test. Test each system as a Unit or in sections; however, each complete system shall successfully meet the requirements specified. Should any defects appear in the pipe or fittings, make the necessary repair and retest the line until requirements are met.

D. Take all necessary precautions to prevent any joints from drawing while the pipelines and their appurtenances are being tested. Repair any damage to the pipes and their appurtenances or to any other structures resulting from or caused by these tests. The costs for such repair will be at CONTRACTOR'S expense.

END OF SECTION

SECTION 15101

VALVES AND APPURTENANCES

PART 1 GENERAL

1.1 WORK INCLUDED

A. Furnish and install valves and miscellaneous piping appurtenances as indicated and specified. Sizes and capacities as indicated or specified.

1.2 RELATED WORK

A. Section 01300 - Submittals

B. Section 01400 - Quality Control

C. Section 01600 - Material and Equipment

D. DIVISION 15 - MECHANICAL

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. A48, Specification for Gray Iron Castings.

2. A126, Standard Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.

3. A536, Specification for Ductile-Iron Castings.

4. B62, Specification for Composition Bronze or Ounce Metal Castings.

5. D1785, Standard Specification for Poly Vinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80 and 120.

B. American National Standards Institute (ANSI):

1. B2.4, Hose Coupling Screw Threads.

2. B16.1, Cast-Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800.

3. B16.4, Cast-Iron Threaded Fittings, Class 125 and 250.

4. B16.10, Face-to-Face and End-to-End Dimensions of Ferrous Valves.

1.4 QUALITY ASSURANCE AND CONTROL

A. Provide per provisions of Section 01400.

B. Supply valves and operators which conform to all applicable AWWA and ANSI standards.

C. Obtain all valves of the same type from a single manufacturer.

D. All valves of a given type shall be the product of one manufacturer who has had valves of like size and design in similar services for at least 5 years.

E. Supply valves with suitable enclosures for specified atmospheres.

1.5 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Submit manufacturer's specifications, catalog data, descriptive matter, illustrations, certified shop drawings, wiring, diagrams, etc.

C. Submit operating instructions and parts lists.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Provide per provisions of Section 01400.

B. Seal valve ends to prevent entry of foreign matter into valve body.

C. Box, crate, completely enclose, and protect valves, operators, and accessories from accumulation of foreign matter.

D. Store valves, operators, and accessories in area protected from weather, moisture, or possible damage.

E. Do not store material directly on the ground.

F. Transport and carefully handle items to prevent interior or exterior damage.

G. Repair or replace damaged material at the CONTRACTOR's expense.

PART 2 PRODUCTS

2.1 CHECK VALVES

A. Valves 2-1/2 inches and smaller:

1. Manufacturers: Asahi/America, Medford, MA (represented by Ryan Herco Products Corporation, Burbank, CA); Crane Valve, Joliet, IL; Stockham Valves and Fittings Co., Birmingham, AL; or approved equivalent.

2. Screwed ends, 200 pound WOG minimum, PVC, bronze or all-brass swing-check valves. Screw-on cap and renewable composition discs.

3. Wetted bronze parts shall contain less than 16 percent zinc.

2.2 BALL VALVES

A. Manufacturers: Asahi/America, Inc., George Fisher., or approved equal.

B. Valves 4 inches and smaller:

1. 150 psi rating at 30°F to 150°F, EPDM O-ring stem seats and teflon seats. PVC body material.

2. Cast in raised letters on body or on tag attached to body by wire: size of opening, name of maker, year of manufacturer, and working pressure for which designed.

C. Ball valves to be Duo Bloc True Union by Asahi/America, Capri by Crane, or approved equal.

2.3 BUTTERFLY VALVES

A. Manufacturers: Asahi/America, or approved equal.

B. Valves 3 inch and smaller:

1. Polypropylene disc, bubble-tight sealing, non-wetted stainless steel shaft.

2. PVC body, and EPDM seats and seals.

C. Valves to be Type 75 Butterfly Valve by Asahi/America, or approved equal.

2.4 SAMPLE PORTS (SP)

A. Sample ports shall allow water and air samples to be collected.

B. Water sample ports are required immediately before and after the air stripper, to be used in evaluating air stripper performance.

C. Air sample ports are required before each carbon vessel, and before and after the zeolite vessel, to be used in monitoring removal efficiency and breakthrough within the vapor treatment system.

D. Sample ports shall be Ryan Herco or approved equal.

2.5 PRESSURE TEST POINTS (PT)

Pressure test points shall be ball valves with threaded spool pieces at the open end of the ball valve to allow insertion and full sealing of a pressure gauge.

Pressure test points shall be located before each carbon vessel, before and after the zeolite vessel, vacuum side of air stripper, and at knockout tank.

PART 3 EXECUTION

3.1 GENERAL

A. Install all valves and accessories as required for the application and in accordance with manufacturer's instructions. Valve size shall be equal to line piping in which valve is installed, unless approved by OWNER. Support all valves where necessary. In case of conflict between these specifications and a governing code, the more stringent standard shall prevail.

B. Provide all accessories necessary for proper valve operation as specified or required for the application. Install buried valves, if necessary, with 2-inch-square operating nuts and concrete valve box with cover. Provide sufficient number of tee wrenches for buried valve operation for all sizes of operating nuts and for placement at convenient locations. Provide buried valves with extension stems if the operating nut would be 30 inches or more below the ground surface.

C. Provide suitable floor stands and operators at approximately 30-inch height where required for proper valve operation. Small lever- or handwheel-operated valves may require handrails or other suitable structures for support of extension stems.

D. Install valves with the operator in a position for convenient operation. Ensure that space is available for operation of lever- or handwheel-operated valves without interference from walls, piping, or equipment.

E. Use operators for manual valves that are lever or handwheel as is standard with the manufacturer unless another type of operator is specified or required by the manufacturer.

F. Prior to installation, protect stored valves and appurtenances from damage due to exposure to sunlight, heat, dirt, debris, freezing and thawing, vandalism, etc.

G. Clean all debris, dirt, gravel, etc. from inside of piping before placing valves in place.

H. Erect and support valves in respective positions free from distortion and strain on appurtenances during handling and installation. Inspect material for defects in workmanship and material. Clean out debris and foreign material from valve openings and seats, test operating mechanisms to check proper functioning, and check nuts and bolts for tightness. Repair valves and other equipment which do not operate easily or are otherwise defective.

I. Set, plumb and provide support for all valves adequately in conformance with instructions of manufacturer. Shim valves mounted on face of concrete vertically and grout in place. Install valves in control piping for easy access. Do not use pipe to support valve unless approved by OWNER.

J. Provide support valves with extension stems where required for convenience of operation. Provide extension stems for valves installed underground and elsewhere so that operating wrench does not exceed 6 feet in length.

3.2 CHECK VALVES

A. Install check valves horizontally in pipeline at each pump discharge, unless otherwise shown on the drawings.

3.3 SAMPLE PORTS

A. Install product sample ports vertically with a U-shape spool piece to send sample fluids down into a sample bottle.

3.4 PRESSURE TEST POINTS

A. Install vertically. Location to provide for easy installation and reading of a pressure gauge.

3.5 VALVE IDENTIFICATION

A. Identify valves of the plumbing systems and indicate their function and system served. Before tagging or labeling, submit to OWNER for approval a final list of valves.

B. Provide all valves with identification as specified in Section 15190. Provide valve chart indicating valve tag number, location of valve, service, and normal position of valve.

C. Identify all valves by the manufacturer, including size, manufacturer's name, and pressure rating.

3.6 ADJUSTMENTS

A. Check and adjust valves and accessories for smooth operation.

B. Lubricate in accordance with manufacturer's recommendations.

3.7 TESTING

A. Test valves with piping as specified in Section 15051.

END OF SECTION

SECTION 15190

PIPING AND EQUIPMENT IDENTIFICATION SYSTEM

PART 1 GENERAL

1.1 SCOPE

A. Provide and install pipe, valve, and equipment identification system as specified herein.

1.2 RELATED SECTIONS

A. Section 01300 - Submittals

B. Section 02300 - Well Installation, Development and Sampling

C. Section 15010 - General Mechanical Requirements

D. Section 15051 - Treatment System Piping and Equipment

E. Section 15101 - Valves and Appurtenances

1.3 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Submit manufacturer's data to OWNER prior to delivery.

PART 2 PRODUCTS

2.1 PIPE IDENTIFICATION

A. Identify pipe with plastic legends and arrows, indicating contents of pipe and direction of flow. Identification shall be located as follows:

1. Adjacent to each valve.

2. At each branch and riser takeoff.

3. At least once in each area that pipe passes through.

4. At least every 20 feet.

2.2 VALVE IDENTIFICATION

A. Attach a stainless steel tag on each valve that is 1.5" or greater. Tag to list model number, size, manufacturer, type, valve position (normally open or close) and date of manufacture. Tags shall be of 19 gauge polished stainless steel 1½" in diameter and stamped for the appropriate service in ¼" black-filled letters. Secure tag to valve with nickel-plated bead chain with locking link, 10"

stainless steel jack chain or 1-3/4" stainless steel "S" hook. Furnish 3 copies of printed valve list showing tag letter- number, service and location.

2.3 EQUIPMENT IDENTIFICATION

A. Identify all mechanical equipment with nameplates securely fastened to the equipment. Nameplate notation shall correspond to notations used on Plans and Specifications. Plates shall be stainless steel 2½" x 3/4" with black enameled background with etches or engraved natural stainless steel lettering.

2.4 ACCEPTABLE MANUFACTURERS

A. Seton Name Plate Corp., W.H. Brady Co., or approved equal.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install identification system in accordance with manufacturer's instructions.

END OF SECTION

SECTION 15990

TESTING, ADJUSTING, AND BALANCING

PART 1 GENERAL

Perform the following directives as they apply to the overall system and its individual components.

1.1 SECTION INCLUDES

A. Testing, adjustment, and balancing of all systems.

B. Measurement of final operating condition of systems.

C. Sound measurement of equipment operating conditions.

D. Vibration measurement of equipment operating conditions.

1.2 RELATED SECTIONS

A. Section 01400 - Quality Control: Inspecting and testing laboratory services.

B. Section 01650 - Starting of Systems

C. Section 15010 - General Mechanical Requirements

D. Section 15051 - Treatment System Piping and Equipment

E. Section 15101 - Valves and Appurtenances

F. DIVISION 16 - ELECTRICAL

1.3 REFERENCES

A. AABC - National Standards for Total System Balance.

B. ASHRAE 111 - Practices for Measurement, Testing, Adjusting, and Balancing of Building Heating, Ventilation, Air-conditioning, and Refrigeration Systems.

C. NEBB - Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.

1.4 REPORT FORMS

A. Submit reports on AABC National Standards for Total System Balance forms.

B. Forms shall include the following information:

1. Title Page:
   a. Company name

b. Company address
c. Company telephone number
d. Project name
e. Project location
f. Project Engineer
g. Project Contractor

2. Instrument List:
   a. Instrument
   b. Manufacturer
   c. Model
   d. Serial number
   e. Range
   f. Calibration date

3. Electric motors:
   a. Manufacturer
   b. HP/BHP
   c. Phase, voltage, amperage; nameplate, actual, no load
   d. RPM
   e. Service factor
   f. Starter size, rating, heater elements

4. Pump Data:
   a. Identification/number
   b. Manufacturer
   c. Size/model
   d. Impeller
   e. Service
   f. Design flow rate, pressure drop, BHP
   g. Actual flow rate, pressure drop, BHP
   h. Discharge pressure
   i. Suction pressure
   j. Total operating head pressure
   k. Shut off, discharge and suction pressures
   l. Shut off, total head pressure

5. Sound Level Report (for all equipment and pumps):
   a. Location
   b. Octave bands - equipment off
   c. Octave bands - equipment on

6. Vibration Test:
   a. Location of points:

      1) Fan bearing, drive end
      2) Fan bearing, opposite end
      3) Motor bearing, center (if applicable)

4) Motor bearing, drive end
5) Motor bearing, opposite end
6) Casing (bottom or top)
7) Casing (side)
8) Duct after flexible connection (discharge)
9) Duct after flexible connection (suction)

1.5 PROJECT RECORD DOCUMENTS

A. Submit record documents under provisions of Section 01700.

B. Accurately record actual locations of flow measuring stations and balancing valves and rough setting.

1.6 QUALITY ASSURANCE

A. Perform Work under supervision of a CONTRACTOR supplied, independent AABC Certified Test and Balance Engineer or registered Professional Engineer.

B. Total system balance shall be performed in accordance with AABC National Standards for Field Measurement and Instrumentation, Total System Balance.

1.7 SEQUENCING AND SCHEDULING

A. Sequence work to commence after completion of systems and schedule completion of work before Completion of Project.

1.8 BALANCING NOTIFICATION

A. Notify OWNER one week prior to commencing work of the Section.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 EXAMINATION

A. Before commencing work, verify that systems are complete and operable. Ensure the following:

1. Systems are started and operating in a safe and normal condition.

2. Equipment is operable and in a safe and normal condition.

3. Temperature control systems (if required) are installed complete and operable.

4. Proper thermal overload protection is in place for electrical equipment.

5. Final filters are clean and in place. If required, install temporary media in addition to final filters.

6. Correct motor rotations.

7. Access doors are closed and end caps are in place.

8. Service and balance valves are open.

B. Report any defects or deficiencies noted during performance of services to OWNER.

C. Promptly report abnormal conditions in mechanical systems or conditions which prevent system balance.

D. If, for design reasons, system cannot be properly balanced, report as soon as observed.

3.2 PREPARATION

A. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to OWNER or ENGINEER to facilitate spot checks during testing.

B. Provide additional balancing devices as required.

3.3 INSTALLATION TOLERANCES

Not used.

3.4 ADJUSTING

A. Adjust work under provisions of Section 01650.

B. Recorded data shall represent actually measured, or observed condition.

C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

D. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

E. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

3.5 GCW AND TREATMENT SYSTEM PROCEDURE

A. Adjust the GCW extraction and treatment system to provide required or design quantities of fluid flow. Adjust levels of extraction and injection pipes in wells, and operation of metering pumps.

B. Effect system balance with automatic control valves fully open.

C. Effect adjustment of fluid distribution systems by means of balancing pumps, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.

D. Where available pump capacity is less than total flow requirements or individual system parts, full flow in one part may be simulated by temporary restriction of flow to other parts.

END OF SECTION

DIVISION 16

ELECTRICAL

SECTION 16010

BASIC ELECTRICAL REQUIREMENTS

PART 1 GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Basic Electrical Materials and Methods: Section 16050

B. Feeder and Branch Circuits: Section 16400

C. Equipment Connections: Section 16405

D. Panelboard: Section 16426

E. Grounding: Section 16450

F. Dry-Type Transformers: Section 16455

G. Variable Frequency Drives: Section 16480

H. Telephone: Section 16710

1.2 WORK INCLUDED

A. The requirements of this section apply to all the sections within Division 16. Applicable requirements of all of these Specifications shall apply to electrical work.

1.3 SYSTEM DESCRIPTION

A. General:

1. Complete functional and operable systems:

a. All specified parts, materials and functions.

b. All detailed systems, equipment, power and controls.

c. Ready for use.

d. Final sizing is dependent on equipment selected by the CONTRACTOR.

e. Ratings indicated on the electrical drawings are for guidance only and do not limit the equipment size.

2. Electrical Systems to be installed:

a. 15kV empty conduit system.

b. 480/277 volt, 3-phase, 4-wire, 60 Hz, distribution.

c. 208/120 volt, 3-phase, 4-wire, 60 Hz, distribution.

d. 120 volt receptacle system.

e. Empty telephone conduit system.

f. Grounding system.

g. Temporary lighting, power and telephone facilities during construction.

B. Labor, Services and Skilled Supervision:

1. Complete Electrical Construction, Erection, Installation and Connection:

a. Materials and equipment specified in this section.

b. Related materials and equipment necessary to complete a system.

c. Wiring equipment specified in other divisions.

2. Adjustment and Testing:

a. Simulate system operation.

b. Proper system operation.

c. Proper limit switch, timer and control settings.

d. System electrical integrity.

(1) Continuity

(2) Insulation resistance

(3) Ground

C. Materials and Equipment

1. Specified in this Division.

2. Necessary to complete the Systems.

3. For equipment specified in other Divisions.

D. Costs Billed by Private or Public Utilities as Service Charges included in Contract price.

1. To extend or connect, the electric or communication supply system.

2. Extend service to site.

3. Temporary power used during construction.

4. Metering installation.

E. Permits and Inspection Certificates:

1. State electrical.

2. Municipal electrical.

1.4 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

A. Shop Drawings and Data: In accordance with procedures set forth in Section 01300, submit complete assembly, foundation, and installation drawings together with detailed specifications and data covering materials used, parts, devices, and other accessories forming part of equipment, including, but not limited to:

1. Motor controls

2. Panelboards

3. Controllers and control devices

4. Dry-type transformers

5. Fused disconnects

6. Ground conductors, rods

7. Conductors, 600 volt

8. Receptacles, 20A and 30A, 125 VAC

9. Junction boxes, one cubic foot and larger

10. Electric heat trace cable

B. Submit drawings and data prior to delivery for OWNER approval.

1.5 WARRANTY

A. Except lamps

B. Free of defects

C. Function properly

PART 2 PRODUCTS

2.1 CODES, ORDINANCES, STANDARDS AND PERMITS

A. Comply With All Codes Applicable to the Work:

1. Bidders inform themselves of all local and state codes and regulations.

2. In case of conflict between Contract documents and governing codes, the most stringent shall take precedence.

3. Where Contract documents exceed minimum code requirements, Contract documents take precedence.

4. No extra payment will be allowed for work or changes required by local code enforcement authorities.

B. Apply for, Obtain and Pay For All Required Permits and Inspection Certificates.

1. Arrange for all inspection by permit enforcing agencies.

2. Deliver all permit compliance documents to OWNER.

C. Underwriters Laboratories Labels Shall Apply To:

1. All materials and devices, etc.

2. Except specified items not covered by existing UL standards.

D. Conflicts With Applicable Regulations

1. Resolve at CONTRACTOR's expense.

2. Prepare and submit details of alternate construction:

a. Acceptable solution of conflict.

b. List of substitute materials:

(1) For approval of inspecting authorities.

(2) For approval of ENGINEER.

2.2 IDENTIFICATION

A. Conductors:

1. Color code:

a. Continuous jacket color.

b. Colored tape wrap at each end and each intermediate junction box.

c. Plastic adhesive tape at each end and each intermediate junction box.

2. Conductor numbers or letters and numbers:

a. Laminated composition or plastic disc (floater) with string loops. Hot stamped sleeves. Identify same at each end and each intermediate junction box.

b. Correspond to design drawing. Prepare as-built record drawing identifying conductor numbers as installed.

3. Phase color code:

a. NEC as applicable.

b. Each phase separate color or color taped.

c. Each circuit voltage separate color.

B. Terminal Strips:

1. Identify each conductor:

a. Conductor number, or,

b. Function, or,

c. Serial number.

2. Provide terminal strips in all junction boxes terminating four or more conduits with #10 and smaller wire.

C. Equipment Without Terminal Strips:

1. Identify each connection point:

a. Tape on equipment body beside terminal screw.

b. Tape or tag on conductor.

c. Correspondence with conductor number.

d. Do not cover manufacturer's contact numbers on equipment.

D. Panelboards and Control Centers, Disconnects and Circuit Breakers:

1. Phenolic Name Plates:

a. Black lettering scribed on white background.

b. Identify purpose, use, pertinent characteristic (volts, phase, etc.)

c. Motor or equipment being controlled.

2. Breaker Panel Circuit Schedule:

a. Remove or furnish directory card.

b. Type neatly assigned circuit use.

c. Replace in panel.

3. Auxiliary Relays and Components:

a. Identify corresponding to drawings.

b. Typed data adhesive tape.

4. Control and Visual Indicating Devices:

a. Identify corresponding to Equipment Specification: Section 11.

b. Use standard nameplate or engraved legend as required.

E. Equipment Identification:

1. Name and number if more than one similar unit:

a. Phenolic engraved nameplate or etched or engraved anodized aluminum.

PART 3 EXECUTION

3.1 INSPECTION OF SITE

A. Each bidder shall thoroughly inspect the site and existing conditions affecting the work prior to bidding.

3.2 CONTRACT DRAWINGS ESSENTIALLY DIAGRAMMATIC FOR CLEARNESS AND LEGIBILITY

A. Equipment shown in desired location.

B. Size and location shown to scale wherever possible, but is approximate unless dimensioned.

C. CONTRACTOR compare all available data to refine location.

D. Verify information and dimensions at building site.

E. Install all work to conform to structure and equipment.

F. Avoid obstructions.

G. Preserve headroom and working clearances.

H. Keep openings and passageways clear.

I. Make accessible all equipment requiring inspection and maintenance.

3.3 PROTECTION, CARE AND CLEANING

A. Protect materials before and after installation against moisture, dirt and damage.

B. At all times, keep the premises clear of undue accumulation of rubbish.

C. On completion of the work, remove all rubbish and debris resulting from this Contract and dispose of same.

D. Equipment and fixtures shall be thoroughly cleaned and left in a satisfactory condition for use.

E. Provide temporary heat in motors and electrical panels, control centers and enclosures to eliminate condensation until installations are placed in normal service.

F. All electrical equipment and fixtures shall be installed in a manner to meet the requirements of a Seismic Zone 3 area.

3.4 DEMONSTRATION OF COMPLETE ELECTRICAL SYSTEM

A. CONTRACTOR to provide assistance for inspection:

1. To OWNER or ENGINEER.

2. To state or local permit inspectors.

3. To utility company inspectors.

4. At all times as requested:

a. Remove covers.

b. Operate machinery.

c. Continuity tests.

d. As necessary to demonstrate quality and adequacy.

B. CONTRACTOR shall operate each:

1. Service entrance unit.

2. Branch feeders.

3. Panelboard circuits.

4. Motor controls and motors.

5. Control systems.

6. Electric controls on installed mechanical equipment.

3.5 TESTS

A. General:

1. Perform all tests as outlined.

2. Additional tests as may be necessary to establish:

   a. Adequacy to perform function.

   b. Quality of workmanship.

   c. Safety.

   d. Completeness.

   e. Suitability.

3. Provide test labor materials and tools.

4. Advance timely notification of test schedules.

5. Correct promptly any failure or defects revealed by test.

6. Retest or transient conditions test may be required in critical cases as required by OWNER.

7. Submit Test Reports to OWNER prior to testing of treatment systems.

B. Driven Ground Rod Resistance Test:

1. Immediately after installation.

   a. Each rod individually.

   b. Combined resistance when 2 or more in group.

2. Maximum 25 ohms at point of system connection.

3. Report contain:

   a. Date of test.

   b. Soil conditions.

   c. Measured resistance.

   d. Submit at once.

C. Wiring Tests:

1. Continuity.

2. Proper wire size:

a. Insulation resistance measured by DC 2000 volt megger:

(1) All circuits including services.

b. Circuits 600 volts or less:

(1) 1,000,000 ohms to ground minimum.

(2) Except circuits over 50 amperes with:

(a) All served devices except fluorescent fixtures connected,

(b) All incandescent lamps removed, motor terminals disconnected,

(c) Panelboards and switchboards with switches closed,

(d) 300,000 ohm to ground minimum.

(3) Insulation between ungrounded conductors not less than 1.5 times minimum insulation to ground.

D. Equipment Tests:

1. Operating amperes:

a. Each motor and heater:

(1) Measure and record each phase.

(2) Equal or less than name plate rated current at 1.0 service factor.

b. Each panel, load center and switchboard:

(1) Measure and record input each phase.

(2) Balance phases by reconnection.

(3) Maximum variation ±10 percent between phase current and average.

c. Power transformers:

(1) Measure and record each phase.

d. Dry type lighting supply transformers:

(1) Measure and record each phase.

E. System Tests:

1. Service voltage: Measure voltage at the service entrance. Voltage shall be within service range A as defined by ANSI C84.1: Electric Power systems and Equipment - Voltage Ratings.

2. Utilization Voltage: Measure voltage at each load of 5 KVA or greater. Other voltage measurements shall be taken as required by OWNER. Voltage shall be within utilization range A as defined by ANSI C84.1: Electric Power Systems and Equipment - Voltage Ratings.

3. Voltage balance:

   d. Maximum 1 percent unbalance at full load.

   e. Cooperate with utility to achieve balance within limits.

   f. Rearrange single phase loads.

   g. Unbalance definition for 1 percent:

      (1) 100 times the sum of the deviation of the three voltages from the average voltage divided by the average voltage.

4. Transient Conditions:

   Where there is reason to believe that transient conditions may from time to time cause the system operating parameters to exceed the observed limits specified in the above performance criteria, perform tests utilizing recording instruments to establish the existence and character of the transient conditions and effectiveness of corrective action taken.

F. Electrical System Test Reports:

1. Indicate all tests performed.

2. Demonstrate conformance with performance criteria.

3. Note corrections made to meet performance.

4. Consult OWNER on report format.

G. Motor Test Reports:

1. Consult OWNER on report format.

2. Provide information on each motor 1/3 horsepower and larger:

   a. Motor use.

   b. Location.

   c. Duplicate of motor nameplate, or tabulation of complete name plate data.

   d. Measured full load current phase A, B, C.

   e. No-load voltage phase AB-BC-CA.

   f. Full-load voltage phase AB-BC-CA.

g. Feeder conductor insulation resistance phase-to-phase and phase-ground.

h. Control circuit function.

i. Rotation direction from drive end.

3.6 RECORD DRAWINGS

A. One Complete Set Blue Line Prints Provided:

1. Keep separate and clean.

2. Reserve for complete picture of work actually installed.

3. Serve as work progress report sheets.

4. Notations made neat and legible.

5. Available all times at job site.

B. Record Layout Actual Routing

C. Completion of Work and Record:

1. Signed by CONTRACTOR.

2. Dated.

3. Two (2) sets delivered to OWNER.

END OF SECTION

SECTION 16050

BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Submittals: Section 01300

B. Basic Electrical Requirements: Section 16010

C. Panelboard: Section 16426

D. Grounding: Section 16450

E. Dry-Type Transformers: Section 16455

F. Variable Frequency Drives: Section 16480

G. Telephone: Section 16710

1.2 QUALITY ASSURANCE

A. General Requirements:

1. New, free from defects, quality as specified.

2. Standard product of known manufacturer.

3. Same manufacturer:

a. Material of the same type or classification.

b. Used for the same purpose.

4. Labeled or listed by approved testing laboratories.

5. Suitable for the intended application.

6. Approved by inspection authorities.

B. Applicable Codes and Standards: Shall be the latest revisions, supplements and amendments to the following:

1. ANSI/NFPA 70: National Electrical Code (NEC).

2. NEMA Standard ICS-2: Industrial Control Devices, Controllers and Assemblies.

3. NEMA Standard KS-1: Enclosed and Miscellaneous Distribution Equipment Switches.

4. NEMA Standard MG-1: Motors and Generators

5. NEMA Standard PB-1: Panelboards

6. NEMA Standard WD-1: General Requirements for Wiring Devices

7. UL Standard 67: Panelboards

8. UL Standard 98: Enclosed and Dead-Front Switches

9. UL Standard 845: Motor Control Centers

10. UL Standard 1004: Electric Motors

11. UL Standard 1673: Electric Heating Cables

1.3 SUBMITTALS

A. Shop Drawings and Data: In accordance with procedures set forth in Section 01300, submit pictorial, assembly and installation drawings together with detailed specifications and data for the material and equipment listed in Section 16010, Par. 1.4.

B. Submit shop drawings and data prior to installation for OWNER approval.

C. In addition to the requirements above, submit two copies of Operation and Maintenance manuals for the following:

1. Motor controls

2. Panelboards

3. Motors

D. Operation and maintenance manuals shall be in addition to any instructions or parts lists shipped with the equipment.

E. Wiring and Connection Diagrams: Submit wiring and connection diagrams for motor controllers and for motor control centers. Extent and detail of wiring diagrams shall comply with NEMA standards for the equipment.

PART 2 PRODUCTS

2.1 RACEWAYS

A. Rigid steel threaded galvanized or sheradized.

B. PVC schedule 40 for all underground runs, except in hazardous areas.

C. Long radius bends for underground runs shall be rigid steel.

D. Locknuts and insulating bushing on terminations.

E. Flexible metallic conduit.

1. Liquidtight flexible conduit.

2. Zinc-coated steel core.

3. Extruded gray PVC cover.

4. Sealtite Type "UA".

F. Minimum size conduit shall be 3/4-inch.

2.2 CONDUCTORS

A. Copper Conductor:

1. 600 volt minimum insulation.

2. Type THW or higher temperature rating.

3. Minimum Wire Size:

a. Power carrying conductors, No. 12 AWG.

b. Control wiring to PB sta., pressure sensors, limit SW. etc., No. 14 AWG stranded.

c. Fixture wire, No. 16 AWG stranded.

4. Insulation colors consistent each phase.

5. Stranded power conductors No. 8 AWG and larger sizes.

6. Terminal lugs and connectors for power and lighting circuits shall be copper alloy pressure type.

B. Aluminum Conductors or Copper Clad Aluminum Conductors:

1. Sized for equivalent ampacity as copper wire size.

2. Same insulation as specified for copper conductors.

3. Bolted pressure and high compression type connectors specially designed for use with aluminum conductors.

4. Connectors to join aluminum and copper conductors approved for dissimilar metals.

5. No. 1/0 AWG and larger sizes.

6. Stranded conductors.

2.3 CONDUIT FITTINGS

A. Cast malleable iron condulets or unilets.

B. Threaded with watertight gasket.

C. Watertight seals on conduit entering underground structures, Type EYS, located inside structure wall.

D. Non-metallic, compatible with PVC schedule 40 raceway.

E. Approved sealable fittings for hazardous rated areas.

2.4 JUNCTION BOXES

A. Size as required by code or as shown on the plans. Allow extra space when splicing.

B. Full access screwed covers mounted with corrosion resistant machine screws.

C. Fabricated from code gauge galvanized sheet steel:

1. Interior and dry locations shown on drawings.

2. Paint with rust-inhibiting primer.

D. Cast metal with threaded hubs FS or FD or type RS with cast plates with threaded hubs:

1. Exterior, damp or underground locations unless otherwise shown on the drawing.

2. Fully gasketed.

3. Size for outlets including gang requirements.

4. Size for conduits, conductors and volume fill by Code.

5. Stainless machine screws for covers and side plates.

2.5 UNDERGROUND PULLBOXES/HANDHOLES

A. Precast concrete underground vaults for electrical and telephone utilities.

B. Vault with floors sloped not less than ¼-inch per foot.

C. Frames and covers made of cast iron.

1. Each unit (frame and cover) heavy-duty type, suitable for street loading, with machined bearing surfaces.

2. Covers indented, solid-top design, with 2 drop handles each and lock.

3. The words “ELECTRIC”, “ELECTRIC H.V.”, or “TELEPHONE”, as appropriate, cast in integral letters no less than 2 inches high on the upper side of each cover.

D. Standard heavy weight cable racks and adjustable inserts set on 3-foot centers around inside perimeter of handhole and arranged so that spare conduit ends are clear for future installation of cables.

1. Provide adequate number of adjustable arms and insulators to accommodate one cable for each conduit entering or leaving handhole.

E. Pulling-in irons fabricated from ¾-inch round stock.

F. All hardware made of steel and hot-dip galvanized after fabrication.

2.6 WIRING DEVICES

A. General:

5. Specification grade, NEMA standard.

B. Switches:

5. 20 ampere 125 volts.

6. Totally enclosed in a molded phenolic case.

7. Flush tumbler type heavy duty.

8. Group under a gang plate where two or more switches in same location.

9. Motor horsepower rated trip-free with overload device for use with fractional HP or more motor loads.

C. Receptacles:

1. 20 amperes, 125 volts, 2 pole, 3 wire NEMA 5-20R unless otherwise noted:

a. Totally enclosed grounding type.

D. Cover Plates:

1. Appropriate size and type.

2. Gasketed weatherproof type of corrosion resistant or galvanized steel or galvanized malleable iron for exterior or damp locations.

3. Gang plates for multiple switches or multiple outlets at one location.

4. Fastening screws corrosion resistant or stainless.

5. Hazardous receptacle cover, spring door and body shall be die cast copper free aluminum.

6. All cover plates at finished walls shall be insulated between the plate and box to prevent air drafts into wall cavities.

2.7 LOCAL CONTROL STATIONS

A. Type and functions as shown on the plans.

B. Heavy duty, fully gasketed.

C. NEMA 12 for indoor locations.

D. NEMA 4 stainless steel for outdoor or damp locations.

E. Heavy duty contact blocks and operators.

F. Lock out stop provisions, with manual Reset.

2.8 MOTOR CONTROLS

A. NEMA Standard:

1. Individual wall mounted units.

2. Control center group mounted units.

B. Combination circuit breaker and magnetic starter unless otherwise specified.

C. Circuit breaker units.

1. Thermal magnetic circuit breakers.

2. Interchangeable trip type.

3. Adjustable magnetic trip elements.

4. Magnetic-only (MCP) type acceptable only if shown on the drawings and if part of an UL listed assembly.

D. Type, size and functions as indicated on the drawings.

1. Across-the-line start.

2. Part winding start.

3. Contacts self cleaning type designed for easy inspection and replacement.

4. Manual toggle switch, quick make, quick break trip-free type.

a. Single phase less than one horsepower.

E. Pilot devices on controller door unless otherwise indicated on the Plans.

1. Start-stop buttons or selector switch (see schematic diagrams).

2. Reset buttons.

3. Running time meter, hours and tenths, non-resetable.

F. Pilot lights shall be transformer push-to-test type with color and functions shown below unless otherwise noted on the drawings.

1. Motor running - green light.

2. Motor stopped - red light.

3. Circuit energized - white light.

G. Overload trips in each phase.

1. Sized for actual motor running current.

H. All disconnect or circuit breaker operators shall have padlocking provisions in open portion with field knockout or drill position for closed position.

I. 120 volts control power through an integral control transformer with 125 VA spare capacity unless otherwise indicated on the drawings.

J. Protective fuse for each control circuit.

K. Terminal strip for all external connections.

2.9 PANELBOARDS

A. Type, size and functions as indicated on the drawings.

B. Dead front, flush or surface mounting.

C. Tin plated aluminum busses, or copper busses, full panel height, rigidly supported with bus supports.

D. Minimum bus rating not to be smaller than feeder protective device setting.

E. Complete with main breaker or main lugs and sub-breakers as shown on the drawings.

F. Circuit breakers:

1. Molded case thermal magnetic trip units.

2. Common trip bar for two or three pole breakers.

3. Trip-free and trip-indicating plug-in type.

4. Quick-make, quick-break contacts.

5. Single, two or three pole breaker interchangeability.

6. Ground fault circuit interrupter (GFCI) where indicated.

G. Zinc-coated sheet steel cabinets, Underwriters' Laboratories, Inc. label. Heavy gauge for embedded installation.

H. NEMA Type 1 enclosures unless otherwise noted.

I. Typewritten directory properly identifying each circuit under the clear plastic cover.

J. Panel bus arrangement:

1. Three phase, 3-wire, 480 volts with ground bus.

2. Three phase, 4 wire, 120/208 volts with solid neutral bar and lug.

K. Gutter space:

1. 5-inch minimum at top and bottom in addition to ground and bus space.

2. 4-inch minimum on sides.

3. Meet NEC requirements.

L. Breaker interrupting rating not less than the following unless indicated differently on the drawings:

Breaker Ampere Rating	Interrupting Capacity 240 V AC	RMS Symmetrical Amperes 480 V AC
20 - 60	10,000	14,000
70 - 125	10,000	14,000
150 - 400	40,000	30,000

2.10 OVERLOAD PROTECTION

A. Size to fit motors.

B. Verify from motor nameplate and measure amp load.

2.11 MOTORS

A. All motors shall be of the horsepower and speed appropriate for the equipment drive, of squirrel cage design, 40° C ambient, and shall be of nationally known manufacture, and shall conform to the applicable standards of the National Electrical Manufacturer's Association.

B. Motors 1 horsepower and over shall be 3-phase. Fractional horsepower motors may be single phase.

C. Insulation shall be not less than Class B and include an epoxy dip coating for protection against accidental submergence. Ambient temperature will be approximately 32°C and under these conditions the service factor shall be 1.0 minimum.

D. The frame shall be suitably protected against corrosion inside and out considering operation in a moist corrosive atmosphere. Bug screens shall be provided on all ventilation openings. Grease fittings shall be provided on all thrust and radial ball bearings.

2.12 ELECTRIC HEAT TRACE CABLE

A. Self-regulating type heat cable, rated for 5 watts/foot at 120 VAC.

B. Low temperature rated, 150º F (65º C) maximum maintenance temperature.

C. Twin 16 AWG copper bus wires, with a semiconductive polymer core and a flame retardant insulation jacket.

D. Cable rated for overlap without burnout, capable of being cut to desired length.

E. Local thermostat controller.

F. Provide with termination kit and flexible power cable with grounding type plug (120V).

G. Cable shall conform to UL Standard 1673.

H. Furnish cable by Chromalox, Type SRL, or equivalent.

PART 3 EXECUTION

3.1 ERECTION

A. The wiring and materials shall be installed by the CONTRACTOR by tradesmen skilled in the installation of this type of work and in accordance with the manufacturer's instructions. All electrical work shall be in accordance with applicable electrical codes.

3.2 RACEWAYS AND CONDUIT

A. Rigid conduit support intervals not greater than:

1. 1-1/2-inches and smaller - 6 foot intervals

2. 2-inch to 6-inch - 10-foot intervals

B. Flexible conduit support intervals not greater than 4-1/2 foot intervals.

3.3 CONDUCTORS

A. Pulling lubricant soapstone or NEC approved materials.

B. No splices between outlet boxes or fittings.

C. Color identify or tag as specified in Section 16010.

D. Conductor ends stripped of insulation without nicking metal.

E. Aluminum conductor terminations shall be made using an approved joint compound over wire and between strands.

F. Aluminum compression terminals installed using approved hydraulic tools.

G. Assure high conductive permanent connections.

3.4 JUNCTION BOXES

A. Mount and support per good standard practice using brackets, rod hangers, bolts, expansion bolts.

B. Support independent of attached conduit.

C. Replace covers and screws when wiring is complete.

D. Install underground junction boxes in accordance to manufacturer's recommendations.

3.5 UNDERGROUND PULLBOXES/HANDHOLES

A. Service vaults shall be sized per Portland General Electric (PGE) or Qwest Communications requirements if not indicated on the drawings.

B. Install per manufacturer's requirements.

3.6 WIRING DEVICES

A. Wall switch outlet 4 feet 0 inches above finish floor.

B. Receptacle outlet 4-ft. 0-in. above finish floor.

3.7 LOCAL CONTROL STATIONS

A. Secure to adjacent wall.

B. Secure to controlled equipment in convenient location.

3.8 MOTOR CONTROLS

A. Separately enclosed starter units:

1. Fasten securely to supporting structure:

a. Wood screws or lag screws to wood boards or timbers.

b. Machine bolts to metal framing or plates.

c. Expansion anchors to concrete walls.

d. Expansion toggle wing bolts or sleeve anchors to hollow block.

e. Provide 1-inch spaces to set panel out from concrete or block wall.

2. Arrange for driven equipment use or function.

a. Similar units adjacent.

b. Multiple units:

(1) In horizontal line uniform to top height.

(2) In groups symmetrical arrangement. Top of highest enclosure not exceeding 6-feet-9-inches above floor and bottom lowest enclosure not less than 1-foot-3-inch above floor.

3.9 PANELBOARDS AND CABINETS

A. Fasten securely to wall:

1. Wood screws or lag screws to wood boards or timbers.

2. Machine bolts to metal framing or plates.

3. Expansion anchors to concrete walls.

4. Expansion toggle wing bolts or sleeve anchors to hollow block.

5. Provide 1-inch space to set panel out from concrete or block wall.

B. Flush mount in wall:

1. Wood screws or lag screws to wood boards or timbers.

2. Machine bolts to metal framing or plates.

3. Expansion anchors/bolts to hollow block or concrete walls.

C. Mounting height:

1. Single unit - 5 feet centerline above floor or ground.

2. Multiple units - uniform top height.

3.10 ELECTRIC HEAT TRACE CABLE

A. Install on vapor inlet line to liquid knockout tank.

B. Cross-wrap cable per manufacturer's instructions.

C. Properly secure cable to valves and piping with UL approved nylon cable ties or fiberglass tape.

D. Install power connection kit per manufacturer's instructions/recommendations in the general area of the power receptacle.

E. Install and connect the flexible power cable and plug assembly.

END OF SECTION

SECTION 16400

FEEDER AND BRANCH CIRCUITS

PART 1 GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Submittals: Section 01300

B. Basic Electrical Requirements: Section 16010

1.2 DESCRIPTION

A. Provide all feeders shown on the Drawings.

B. Provide branch circuits to all outlets, devices, motors, appliances and electrical equipment unless otherwise noted.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 INSTALLATION

A. All feeder conductors to be continuous from origin to panel or equipment without splice in intermediate pull or splice box. Unless otherwise indicated each feeder raceway to contain only those conductors constituting a single feeder.

B. Feeder raceways to enter directly opposite terminal lugs where possible.

C. Provide feeder conductor identification in accordance with Section 16010: Basic Electrical Requirements.

D. Install branch circuit wiring in raceways throughout project unless otherwise indicated.

E. Verify roughing-in requirements prior to installation of branch circuits. See equipment schedules, architectural, mechanical and structural Drawings for equipment locations.

F. See Section 16050; Basic Electrical Materials and Methods, for general installation requirements.

END OF SECTION

SECTION 16405

EQUIPMENT CONNECTIONS

PART 1 GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Submittals: Section 01300

B. Basic Electrical Requirements: Section 16010

1.2 DESCRIPTION

A. Connect to all equipment noted or as scheduled on the Drawings, and provide all cords, cord caps, circuit protection, disconnect switches and necessary devices required for proper connection of equipment.

B. All control devices furnished by subcontractor are to be set in place by the subcontractor unless otherwise noted. Control wiring between starters, pneumatic electric switches, electrically operated control components, etc. provided by electrical contractor unless indicated otherwise.

PART 2 PRODUCTS

2.1 MATERIALS

A. Disconnect switches: Heavy duty unfused unless otherwise noted. Disconnect switches for fractional horsepower, single phase motors may be motor rated toggle switches. Enclosures for disconnect switches as shown or required for conditions encountered.

PART 3 EXECUTION

3.1 INSPECTION

A. Verify exact location and method of connection to each piece of equipment prior to roughing-in. Where roughing-in requirements are different from that shown on the Drawings, verify with ENGINEER before proceeding.

B. Determine voltage and phase of each item before connecting, and if characteristics are not proper for energy available immediately notify OWNER.

C. Verify location of all control devices with subcontractor.

D. Examine location of all equipment to assure adequate clearance for operation and connection.

E. Obtain drawings from subcontractor and equipment suppliers to insure proper connections.

3.2 INSTALLATION

A. Connect motors to provide proper direction of rotation.

B. Make connections to equipment in accordance with manufacturer's instructions and NEC requirements.

C. Install raceway entrances to roof mounted equipment inside equipment bases wherever possible to eliminate penetrating roofs.

D. Test all circuits for fusing, continuity and control.

E. Coordinate work with other subcontractors.

END OF SECTION

SECTION 16426

PANELBOARDS

PART 1 GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Submittals: Section 01300

B. Basic Electrical Requirements: Section 16010

C. Basic Electrical Materials and Methods: Section 16050

1.2 DESCRIPTION

A. The CONTRACTOR shall furnish and install the panelboards as specified and as shown on the contract Drawings.

1.3 QUALITY ASSURANCE

A. General Requirements:

1. New, free from defects, quality as specified.

2. Standard product of known manufacturer.

3. Labeled or listed by approved testing laboratories.

4. Suitable for the intended application.

5. Approved by inspection authorities.

6. Conforming to applicable standards of NEMA, ANSI and IEEE.

7. Service entrance products shall meet EUSERC Standards.

B. Acceptable Manufacturers:

1. General Electric.

2. Square D.

3. I-T-E (Siemens).

4. Cutler-Hammer.

5. Or approved equal.

C. The panelboards and all components shall be designed, manufactured and tested in accordance with the latest applicable standards, supplements and amendments to the following:

1. ANSI/NFPA 70: National Electrical Code (NEC).

2. UL 67: Panelboards.

3. UL 50: Cabinets and Boxes.

4. NEMA PB1.

5. Circuit Breaker: Type I Class I.

6. EUSERC: Electric Utility Service Equipment Requirements Committee.

1.4 SUBMITTALS

A. Shop Drawings and Data: In accordance with procedures set forth in Section 01300, submit the following:

1. Breaker layout drawing with dimensions indicated and nameplate designation.

2. Component list.

3. Conduit entry/exit locations.

4. Assembly ratings including:

a. Short-circuit rating

b. Voltage

c. Continuous current

5. Cable terminal sizes.

1.5 QUALIFICATIONS

A. The manufacturer of the panelboard shall be the manufacturer of the major components within the assembly, including circuit breakers.

B. For the equipment specified herein, the manufacturer shall be ISO 9000, 9001 or 9002 certified.

C. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by OWNER, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

D. The panelboards shall be suitable for and certified to meet all applicable seismic requirements of Uniform Building Code (UBC) for Zone 3 application. Guidelines for the installation consistent with these requirements shall be provided by the switchgear manufacturer and be based upon testing of representative equipment.

1.6 DELIVERY, STORAGE AND HANDLING

A. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.

PART 2 PRODUCTS

2.1 RATINGS

A. Panelboards rated 240 Vac or less shall have short-circuit ratings as shown on the drawings, but not less than 10,000 amperes RMS symmetrical.

B. Panelboards rated 480 Vac shall have short-circuit ratings as shown on the drawings, but not less than 14,000 amperes RMS symmetrical.

C. Panelboards shall be labeled with a UL short-circuit rating. When series ratings are applied with integral or remote upstream devices, a label or manual shall be provided. It shall state the conditions of the UL series ratings including:

1. Size and type of upstream device.

2. Branch devices that can be used.

3. UL series short-circuit rating.

2.2 ENCLOSURE CONSTRUCTION

A. Interiors shall be completely factory assembled devices. They shall be designed such that switching and protective devices can be replaced without disturbing adjacent units and without removing the main bus connectors.

B. Distribution panelboard trims shall cover all live parts. Switching device handles shall be accessible.

C. Surface trims shall be same height and width as box. Flush trims shall overlap the box by 3/4-inch on all sides.

D. A directory card with a clear plastic cover shall be supplied and mounted on the inside of each door.

E. All locks shall be keyed alike.

F. Enclosures shall be at least 20-inches wide made from galvanized steel. Provide minimum gutter space in accordance with the National Electric Code. Where feeder cables supplying the mains of a panel are carried through its box to supply other electrical equipment, the box shall be sized to include the additional required wiring space. At least four (4) interior mounting studs with adjustable nuts shall be provided.

G. Enclosures shall be provided with blank ends.

2.3 BUS

A. Main bus bars shall be plated aluminum or copper sized in accordance with UL standards to limit temperature rise on any current carrying part to a maximum of 65 degrees C above an ambient of 40 degrees C maximum.

B. A bolted ground bus shall be included in all panels.

C. Full-size (100%-rated) insulated neutral bars shall be included for panelboards as shown with neutral. Bus bar taps for panels with single-pole branches shall be arranged for sequence phasing of the branch circuit devices. Neutral busing shall have a suitable lug for each outgoing feeder requiring a neutral connection. 200%-rated neutrals shall be supplied for panels designated on drawings with oversized neutral conductors.

2.4 WIRING/TERMINATIONS

2.5 DISTRIBUTION PANELBOARDS: CIRCUIT BREAKER TYPE

A. Distribution panelboards with bolt-on devices contained therein shall have series or integrated rated interrupting ratings as indicated on the drawings. Panelboards shall have molded case circuit breakers as indicated below.

B. Molded case circuit breakers shall provide circuit overcurrent protection with inverse time and instantaneous tripping characteristics. Ground fault protection shall be provided where indicated.

C. Circuit breakers shall be operated by a toggle-type handle and shall have a quick-make, quick-break over-center switching mechanism that is mechanically trip-free. Automatic tripping of the breaker shall be clearly indicated by the handle position. Contacts shall be non-welding silver alloy and arc extinction shall be accomplished by means of DE-ION arc chutes. A push-to-trip button on the front of the circuit breaker shall provide a local manual means to exercise the trip mechanism.

D. Circuit breakers shall have a minimum symmetrical interrupting capacity as indicated on the drawings.

E. Where indicated, circuit breakers shall be UL listed for series application.

F. Provide main circuit breakers UL listed for application at 100% of their continuous ampere rating in their intended enclosure.

G. Provide shunt trips, bell alarms, and auxiliary switches as shown on the contract drawings.

2.6 FINISH

A. Surfaces of the trim assembly shall be properly cleaned, primed, and a finish coat of gray ANSI 61 paint applied.

PART 3 EXECUTION

3.1 INSPECTION

A. Verify location and mounting requirements for the equipment.

B. Verify voltage prior to installation.

C. Examine switchboard equipment for damage and replace prior to installation.

3.2 INSTALLATION

A. General

3. Install panelboard in accordance with manufacturer's instructions, the drawings, and NEC.

4. Properly ground to building ground system.

5. Properly support and align and provide all necessary accessories and steel shapes for support and alignment.

6. Installation to meet requirements for a Seismic Zone 3 area.

7. Coordinate switchboard installation with the facility construction.

3.3 TESTING

A. Refer to Section 16010, this Division, for general testing criteria.

B. Test the switchboard for proper operation and correct phasing.

C. Perform all tests as recommended by the manufacturer and/or requested by the OWNER.

END OF SECTION

SECTION 16450

GROUNDING

PART 1 GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Submittals: Section 01300

B. Basic Electrical Requirements: Section 16010

C. Basic Electrical Materials and Methods: Section 16050

1.2 DESCRIPTION

A. Furnish all labor, material, equipment, instruments, supervision, and accessories as required to install the grounding system required. Equipment grounds, including conduits, shall have separate grounding conductors above grade. Grounds at various equipment locations may be combined into single conductors connecting to below grade grids.

B. Provide grounding of all electrical equipment per code rules and established safety practices.

C. Provide grounding stations for system neutrals.

1.3 QUALITY ASSURANCE

A. Applicable Codes and Standards: Shall be the latest revisions, supplements and amendments to the following:

1. ANSI C2: National Electrical Safety Code (NESC).

2. ANSI/NFPA 70: National Electrical Code (NEC).

3. UL Standard 467: Grounding and Bonding Equipment.

B. Acceptable Manufacturers:

1. Ground Rods:

a. A.B. Chance Co.

b. Copperweld Corporation

c. Porcelain Products

d. Willard Industries

e. American Electric

2. Cable-to-Equipment Ground Lugs:

a. Burndy Corporation (Burndy)

b. Erico Products

c. O.Z. Gedney Company

3. Coatings:

a. Kop-coat, Carboline Company

1.4 SUBMITTALS

A. Submittals: In accord with Section 01300.

B. Includes, but not limited to, catalog cuts for the following:

1. Ground Rods

2. Connectors

PART 2 PRODUCTS

2.1 MATERIALS

A. All materials shall be in accordance with the requirements as specified in the referenced Specification details.

B. Wire and Cable:

1. In general, ground cables shall be bare, or insulated soft or medium hard drawn, Class A or Class B stranded copper, of sizes shown on the drawings.

2. Conductor Sizes:

a. As indicated for specific connections or as required by NEC.

b. For required connections not indicated, use conductor size not less than No. 2/0 AWG if buried in earth or cast in concrete, or No. 6 AWG at other locations.

C. Ground Rods:

1. Copper-clad steel or copper-alloy sectional-type rods. Copperweld 9400 Series or equivalent.

2. One end pointed to facilitate driving.

3. 3/4-inch diameter and 10-feet long with diameter and length stamped near top of rod.

D. Connection Materials:

1. Below Ground

    a. Cable-to-cable, cable-to-rod, and cable-to-connector connections of exothermic-welding-type process.

2. Above Ground

    a. Compression type unless otherwise indicated on the drawings.

    b. Bolted to equipment housing with silicon bronze bolts and lock washers.

3. Cable to building column connections by exothermic-welding type process.

4. Ground Rod Clamps: One piece cast bronze with safety set screw. Copperweld 6500 Series or equivalent.

E. Coatings

1. Kop-coat Bitumastic No. 50 asphaltic coating.

PART 3 EXECUTION

3.1 INSPECTION

A. Do not cover connections before they are inspected by ENGINEER.

3.2 INSTALLATION

A. General

1. Copper ground wire shall be used on interior and exterior installations and in conduit runs for equipment grounding.

2. All electrical equipment and conduit installed under this contract shall be grounded as required by NEC, indicated on the contract drawings and as specified herein.

B. Wire and Cable

1. Install using as few joints as possible.

2. Suitably protect cable against damage during construction.

3. Replace or suitably repair cable if damaged by anyone before final acceptance.

4. Route runs as indicated or required by NEC.

5. Route where possible for maximum physical protection.

C. Ground Rods

1. Install rods as indicated by driving and not by drilling or jetting.

2. Drive rods into unexcavated portion of the earth where possible.

3. Where rods must be installed in excavated areas, drive rods into earth after compaction of backfill is completed.

4. Drive to a depth such that top of rods will be approximately 24 inches below final grade, or subgrade, and connect main grid ground cable thereto.

D. Connections

1. Conform to manufacturer's instructions.

2. Chemically degrease and dry completely before welding connections.

3. Apply one coat of asphaltic coating to all exothermic-welded connections to be buried.

4. Make connections to equipment as follows:

a. Make up clean and tight to assure a low-resistance connection with resistance drop not exceeding 1 Ohm.

b. Install so as not to be susceptible to mechanical damage during operation or maintenance of equipment.

E. Metallic Conduit Ground

1. Adequately and properly ground at all terminal points and wherever isolated from equipment or grounded steel.

2. Where extending into floor-mounted equipment from below, connect to equipment ground bus or frame.

3. All conduit shall be grounded directly or through equipment frames and ground busses to the ground system conductor which shall be minimum of No. 6 bare copper.

F. Box Grounds

1. Unless grounded by conduit system, ground all boxes by direct copper connection.

3.3 FIELD TESTING

A. Measure resistance of ground system to each ground riser.

B. Record results and notify ENGINEER if any reading exceeds 10 ohms. If the resistance exceeds 10 ohms, then ground rod(s) shall be added. Additional rods shall be driven at least 6 feet away from any existing rods and shall be tied to the existing ground system.

C. Test at least three of each type of ground connections and not less than 25 percent of all ground connections.

D. Test by one of the following methods for resistance measurement:

1. Three-point method, using an ammeter and voltmeter and a-c- or d-c power supply.

2. Commercial instrument method approved for such type testing.

END OF SECTION

SECTION 16455

DRY-TYPE TRANSFORMERS

PART 1 GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Submittals: Section 01300

B. Basic Electrical Requirements: Section 16010

1.2 DESCRIPTION

A. Furnish all labor, material, equipment, instruments, supervision, and accessories as required to install new dry-type transformers.

B. All transformers shall be properly grounded as indicated on the drawings or as required by the NEC and established safety practices.

1.3 QUALITY ASSURANCE

A. Applicable Codes and Standards: Shall be the latest revisions, supplements and amendments to the following:

1. ANSI C2: National Electrical Safety Code (NESC).

2. ANSI/NFPA 70: National Electrical Code (NEC).

3. ANSI Standard C57.12.50: Ventilated Dry-Type Distribution Transformers.

4. NEMA Standard ST20: Dry-Type Transformers for General Applications.

5. UL Standard 1561: Dry-Type General Purpose and Power Transformers.

B. Acceptable Manufacturers:

1. General Electric

2. Westinghouse

3. Square D

4. I-T-E (Siemens)

5. Or approved equal

1.4 SUBMITTALS

A. Submittals: In accord with Section 01300.

B. Includes, but not limited to, catalog cuts for the following:

1. Transformer, 3-phase, 480 volts delta primary, 120/208 volts secondary, 60 hertz.

PART 2 PRODUCTS

2.1 MATERIALS

A. Design Requirements:

1. Transformer sizes shall be as indicated.

2. Transformer construction and testing shall meet or surpass all applicable requirements of "Applicable Codes and Standards".

3. All transformers shall bear the UL label and shall be acceptable for installation in the locations indicated.

4. All transformers shall be supplied from the same manufacturer.

2.2 DRY-TYPE TRANSFORMERS

A. Three phase transformers shall be 480 volt delta primary. Transformers shall have a minimum of 4-2 1/2% full capacity primary taps.

B. Transformers shall be 150°C temperature rise above 40°C ambient. All insulating materials to be in accordance with NEMA ST20 Standard for a 220°C UL component recognized insulation system.

C. Transformer coils shall be of the continuous wound construction and shall be impregnated with nonhygroscopic, thermosetting varnish.

D. All cores to be constructed of high grade, non-aging silicon steel with high magnetic permeability, and low hysteresis and eddy current losses. Magnetic flux densities are to be kept well below the saturation point. The core laminations shall be clamped together with structural steel angles. The completed core and coil shall then be bolted to the base of the enclosure but isolated therefrom by means of rubber, vibration-absorbing mounts. There shall be no metal-to-metal contact between the core and coil and the enclosure. The vibration isolating system shall be designed to provide a permanent fastening of the core and coil to the enclosure. Sound isolating systems requiring the complete removal of all fastening devices will not be acceptable.

E. Transformers shall be in a heavy gauge, sheet steel, ventilated enclosure. The ventilating openings shall be designed to prevent accidental access to live parts in accordance with UL, NEMA, and National Electrical Code standards for ventilated enclosures. Transformers through 112.5 KVA shall be designed so they can be either floor or wall mounted. Above 112.5 KVA they shall be floor mounted design.

F. The entire transformer enclosure shall be degreased, cleaned, phosphatized, primed, and finished with a grey, baked enamel.

G. The maximum temperature of the top of the enclosure shall not exceed 50°C rise above a 40°C

ambient.

H. The core of the transformer shall be visibly grounded to the enclosure by means of a flexible grounding conductor sized in accordance with applicable NEMA, IEEE, and ANSI standards.

I. Sound levels shall be guaranteed by the manufacturer not to exceed 50 dB.

PART 3 EXECUTION

3.1 INSPECTION

A. Verify location and mounting requirements for each transformer.

B. Verify voltage at each transformer prior to installation.

C. Examine transformers for damage and replace prior to installation.

3.2 INSTALLATION

A. Install transformers in accordance with manufacturer's instructions, the drawings, and NEC.

B. Properly ground transformers to building ground system.

C. Properly support and align transformers and provide all necessary accessories and steel shapes for support of the transformers.

D. Coordinate complete transformer installation with the facility construction.

3.3 TESTING

A. Refer to Section 16010, this Division, for general testing criteria.

B. Test all transformers for proper operation and correct phasing.

C. Perform all tests as recommend by the transformer manufacturer and requested by OWNER.

END OF SECTION

SECTION 16480

VARIABLE FREQUENCY DRIVES

PART 1 GENERAL

1.1. RELATED WORK SPECIFIED ELSEWHERE

A. Basic Electrical Requirements: Section 16010

B. Basic Electrical Materials and Methods: Section 16050

1.2. DESCRIPTION OF WORK

A. This section covers furnishing and installing variable frequency drive units for the groundwater circulation wells, hereafter referred to as VFDs.

B. The CONTRACTOR shall be responsible for correctly sizing and matching the variable frequency drives to the motors.

1.3. QUALITY ASSURANCE

A. Applicable codes and standards shall be the latest revisions, supplements and amendments to the following:

1. NFPA 70 - US National Electrical Code.

2. NEMA ICS 3.1 - Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable Speed Drive Systems.

3. NEMA 250 - Enclosure for Electrical Equipment.

4. UL 508C - Underwriter's Laboratory.

5. Manufacturer shall be ISO 9000, 9001, or 9002 certified.

1.4. SUBMITTALS

A. Submit project data in accordance to submittal requirements in Section 16010 and the following. Submit catalog data showing material information and conformance with specifications. The intended use of each item shall be indicated. Submittals should include the following information:

1. Outline dimensions plus exterior and interior equipment elevation drawings.

2. Wiring diagrams with all interface points and terminal numbers clearly identified.

3. Specific information on the VFDs components provided for this project and all optional equipment provided.

4. Operations and programming manual.

5. Maximum watt dissipated at nominal current for each VFD.

6. Prior to installation, the VFD manufacturer shall provide the estimated total harmonic distortion (THD) caused by the VFDs. The results shall be based on a computer aided circuit simulation based on the rating of the transformer supplying the VFDs.

1.5. COORDINATION

A. Coordinate the installation of the VFDs into Control Panel per Section 11201. Provide all additional equipment necessary for mounting and connection of all features and coordinate for the necessary space.

2. PRODUCTS

2.1. GENERAL

A. Provide 18 pulse variable frequency drives (VFDs) to control the speed of variable torque loads with horsepower ratings as selected by the contractor.

B. The VFD motor controller shall convert 460 volt, three phase, 60 Hertz utility power to adjustable voltage (0-460V) and frequency (0-120 Hz) three-phase, AC power for stepless motor speed control with a capability of 10:1 speed range. All general options and modifications shall mount within the standard adjustable frequency controller in a NEMA 1 enclosures.

C. The VFDs solid state, with a pulse width modulated (PWM) output wave form (current source drives are not acceptable). The VFD package as specified herein shall be completely assembled and tested by the manufacturer. The VFD shall employ 2.5% to 3% line reactors, a full wave rectifier (to prevent input line notching), DC link choke, capacitors, and insulated gate bipolar transistors (IGBTs) as the output switching device (SCRs, GTOs and darlington transistors are not acceptable). The drive efficiency shall be 97% or better at full speed and full load. Fundamental power factor shall be 0.95 or better at all speeds and loads.

D. The controller(s) shall be suitable for use with any premium efficiency NEMA-B squirrel-cage induction motor(s) having a 1.15 service factor. At any time in the future, it shall be possible to substitute any standard motor (equivalent horsepower, voltage and RPM) in the field.

E. The variable frequency control shall operate satisfactorily when connected to a bus supplying other solid state power conversion equipment which may be causing up to 10% total harmonic voltage distortion and commutation notches up to 36,500 volt microseconds, or when other VFDs are operated from the same bus.

F. The variable frequency control shall include transient voltage suppression to allow reliable operation on a typical industrial or commercial power distribution system.

2.2. SIZE AND QUANTITY

A. Drives shall be provided and sized as follows:

1. One drive shall be provided for each influent and effluent submersible pump in Section 11201.

2. It is the CONTRACTOR's responsibility to correctly size the VFD's to the motor full load currents.

2.3. BASIC FEATURES

A. All VFD's shall have the following standard features:

1. The enclosure door of each VFD unit shall include a "POWER ON light, a VFD fault light, a VFD run light, a fault reset pushbutton and a non-resettable run time meter.

a. VFD speed shall be adjustable via the following separate inputs

b. VFD/OMI Keypad

2. VFD shall not run on a single phasing condition or a phase reversal condition after being started up.

3. All VFDs shall have the same customer interface, including digital display, keypad and customer connections; regardless of horsepower rating. The keypad is to be used for local control (start/stop, forward/reverse, and speed adjust), for setting all parameters, and for stepping through the displays and menus.

4. The VFD shall be selectable to provide automatic restart after a trip condition resulting from overcurrent, overvoltage, undervoltage, or over-temperature. For safety, the drive shall shut down and require manual reset and restart if the automatic reset/restart function is not successful within a maximum of three attempts within a short time period.

5. The VFD shall have the software capability for selecting an automatic restart after utility failure. Initially the software shall be setup so that the VFD does not automatically restart after utility failure.

6. The VFD shall give the user the option of either (1) displaying a fault, or (2) running at a programmable preset speed if the input reference (data highway) is lost; as selected by the user.

7. The VFDs shall utilize plain English digital display (code numbers are not acceptable). All set-up parameters, indications, faults, warnings and other information must be displayed in words to allow the user to understand what is being displayed without the use of a manual or cross-reference table.

8. If available, the VFDs shall utilize pre-programmed application macros specifically designed to facilitate start-up. The application macros shall provide

one command to reprogram all parameters and customer interfaces for a particular application to reduce programming time.

9. The inverter output shall be generated by power transistors which shall be controlled by six identical base driver circuits. The VFD shall not induce excessive power losses in the motor. The worst case RMS motor line current measured at rated speed, torque and voltage shall not exceed 1.05 times the rated RMS motor current for pure sine wave operation.

10. The VFD shall have DC Link Choke to reduce the harmonics to the power line.

11. Frequency resolution and accuracy shall be minimum 0.5%.

12. The VFD shall be optimized for a 3 kHz carrier frequency. The carrier frequency shall be adjustable from 3-9kHz.

2.4. SERVICE CONDITIONS

A. The controller shall be designed and constructed to operate within the following service conditions:

1. Elevation: To 3300 feet

2. Ambient Temperature Range: 0°C to 40°C

3. Atmosphere: Non-Condensing relative humidify to 95%

4. AC Line Voltage Variation: -10% to +10%

5. AC Line Frequency Variation: +3 Hertz

2.5. KEY PAD / DISPLAY UNIT

A. The VFD shall be supplied with a key pad unit for programming and changing parameters. The unit shall have a keypad and digital display. The following operating adjustments and information shall be standard but not limited on the VFD control pad. The display shall be in complete English words (alpha-numeric codes are not acceptable):

1. Display

a. Output Frequency

b. Motor Speed (RPM, % or Engineering units)

c. Motor Current

d. Calculated Motor Torque

e. Calculated Motor Power

f. DC Bus Voltage

g. Output Voltage

h. Analog Input Values

i. Control Mode: Manual or Automatic

j. Adjustments

2. The controller shall have the following adjustments accessible through the control pad display unit:

a. Control mode: Manual or Automatic

b. Maximum Frequency: 60, 90 or 120 Hz.

c. Speed: Frequency-Max., Frequency-Min.

d. Independent acceleration/deceleration rates: 2 -120 seconds

e. Voltage Parameters: V-min, V-max, V/Hz.

f. Current Limit: 50 - 110% of drive rating

g. Inverse time overload, limit, time

h. Current Boost

i. Speed Profile: Entry, Exit, Min. Speed, Max. Speed

j. Auto Start: delay on/off, on/off levels

B. All drive setting adjustments and operation parameters shall be stored in a parameter log which lists allowable maximum and minimum points as well as the current set values. This parameter log shall be accessible via a serial port as well as on the keypad.

2.6. ENCLOSURE

A. All VFD components shall be factory mounted and wired in NEMA 1 enclosures as shown on the plans. The wiring and space requirements shall be met as shown on the plans. All accessory and related equipment for control and harmonic reduction shall also be mounted within the VFD enclosure space as shown on the plans.

B. Provide removable washable air filters and forced air cooling system.

2.7. PROTECTIVE FEATURES AND CIRCUITS

A. The VFD shall have the following protection circuits. In the case of a protective trip, the drive shall stop, and announce the fault condition in complete words (alpha-numeric codes are not acceptable).

1. Adjustable overcurrent trip.

2. Adjustable overvoltage trip.

3. Adjustable undervoltage trip.

4. Overtemperature protection.

5. Single phase fault or 3-phase fault short circuit on VFD output terminals without damage to any power component. The VFD shall be rated minimum 35kAIC or for the AIC as shown on the one-line.

6. Static overspeed (overfrequency) protection

7. LED monitor lamps for each inverter stage

8. LED status indicators on regulator, printed circuit board face plates.

9. Individual transistor overcurrent protection

10. The VFD shall be capable of starting into a rotating load (forward or reverse) and accelerate or decelerate to setpoint without safety tripping or component damage (flying start).

11. The VFD shall be equipped with an automatic extended power loss ride-through circuit which will utilize the inertia of the load to keep the drive powered. Minimum power loss ride-through shall be one-cycle, based on full load and no inertia. Removing power from the motor is not an acceptable method of increasing power loss ride-through.

12. The customer terminal strip shall be isolated from the line and ground.

13. The drive shall employ an adjustable (not greater than 115%) current limit circuits to provide trip free operation:

14. The overload rating of the drive shall be 110% of its variable torque current rating for 1 minute every 10 minutes, and 140% of its torque current rating for 2 seconds every 15 seconds.

15. The VFD shall have a disconnect switch interlocked with the enclosure door.

16. Adaptable Electronic Motor Overload (I^2t). The electronic Motor Overload protection shall protect the motor based on speed, load curve, and external fan parameter, and shall be UL listed. (or shall be provided by solid state adjustable overload relay).

17. Provide programmable carrier frequency and volts/Hz.

18. Provide 1 second minimum power ride through.

19. The drive shall shut down on single phasing or phase reversal.

2.8. DIAGNOSTIC FEATURES AND FAULT HANDLING

A. The following conditions shall cause a safe drive shutdown:

1. Loss of input power.

2. Undervoltage.

3. Sustained gradual overload.

4. Instantaneous severe overload.

5. Power transistor overtemperature.

6. Blown fuse.

7. Logic power supply failure.

B. The VFD shall include a comprehensive microprocessor based digital diagnostic system which monitors its own control functions and displays faults and operating conditions.

C. A "FAULT LOG" shall record the VFD operating mode, elapsed time, reset and mode or fault for the 3 most recent events.

D. Fault log record shall be accessible via a RS232 serial link as well as line by line on the keypad display.

2.9. DRIVE OPTIONS

A. Provide all necessary options for the drives to meet the power and control functions as shown and implied by the plans, specifications and programming statements and to meet the requirements of the total power and control system including the following: All options shall be factory mounted and wired within the VFD enclosure unless otherwise specified.

1. Three (3) programmable digital relay outputs. The relays shall be rated for maximum switching current 8 amps at 24 VDC and 0.4 amps at 250 VAC; Maximum voltage 300 VDC and 250 VAC; Continuous current rating 2 amps RMS. Outputs must be true form C type contacts; open collector outputs are not acceptable.

2. Three (3) programmable preset speeds.

3. Two independently adjustable acceleration and deceleration ramps. These ramp times shall be adjustable from 1 to 120 seconds.

4. The VFD shall Ramp or Coast to a stop, as selected by the user.

5. The VFD shall have a scan port link as standard.

6. The VFD shall be able to communicate with the PLC through Allen-Bradley DeviceNet interface.

7. Accessories to be furnished and mounted by the drive manufacturer.

8. All wires to be individually numbered at both ends for ease of troubleshooting.

9. Door interlocked disconnect switch which will disconnect all input power from the drive and all internally mounted options. The disconnect handle shall be thru-the-door type, and be padlockable in the "Off" position. Provide an interlock defeat feature.

2.10. SYSTEM OPERATION

A. Provide all necessary components, inputs, outputs, and options such that the VFD will operate according to the following:

1. With the Keypad in manual control the VFD shall be controlled via the keypad.

2.11. COMMUNICATIONS

A. Provide all necessary components and options such that the VFD will communicate with the PLC to control the motor and its speed from the wet well level controls.

2.12. QUALITY ASSURANCE AND FACTORY TESTS

A. The controller shall be subject to, but not limited to, the following quality assurance controls, procedures and tests:

1. Power transistors, SCRs and diodes shall be tested to ensure correct function and highest reliability.

2. Every controller will be functionally tested with a motor to ensure that if the drive is started up according to the instruction manual provided, the unit will run properly.

2.13. ACCEPTABLE MANUFACTURERS

A. Allen-Bradley.

B. Or approved equal.

3. EXECUTION

3.1. INSTALLATION

A. Prior to Installation at the site, the VFDs shall be shipped to the control panel manufacture's facility for system testing. Shipping and handling cost from each location to the site shall be included in the bid.

B. Installation shall be the responsibility of the CONTRACTOR. The CONTRACTOR shall install the drive in accordance with the contract drawings and the recommendations of the VFD manufacturer as outlined in the installation manual.

C. Power and control wiring shall be completed by the electrical CONTRACTOR. The CONTRACTOR shall complete all wiring in accordance with the recommendations of the System Integrator and VFD manufacturer as outlined in the installation manual.

D. VFD carrier frequency shall be set no higher than 3 kHz.

3.2. START-UP

A. Start up of the drive shall be performed by personnel who have been trained by the manufacturer in a certified training course. A certified start-up form shall be filled out for each drive with a copy provided to the ENGINEER, OWNER, and a copy kept on file at the manufacturer. Cost for this startup support shall be included in the VFD bid price. The OWNER shall be notified a minimum 1 week in advance of the scheduled start-up.

3.3. OPERATION AND MAINTENANCE TRAINING

A. CONTRACTOR shall provide specific training in the use of the VFD during the training period at the end of the operation period as described in Section 11201. This VFD training shall include:

1. Preventative maintenance procedures.

2. Trouble-shooting.

3. Calibration.

4. Testing.

5. Replacement of components.

3.4. MANUFACTURER'S FIELD SERVICE

A. Field Engineering Support: The manufacturer shall maintain a service center capable of providing training, parts and emergency maintenance and repairs at the Project site with 8 hours maximum response time.

B. Spare Parts Support: Parts supplies shall be located in the field to provide 80% of all emergency needs. The factory shall serve as the central stocking facility where a dedicated supply of all parts shall be available within 24 hours.

C. Factory Technical Support. Parts and support shall be available 24 hours/day, 7 days/week. Parts shall be available to ship overnight.

D. Factory shall provide on site support for start up and maintenance.

E. A local stocking distributor shall be located within a 20 mile radius of the City of Portland.

END OF SECTION

SECTION 16710

TELEPHONE

1. GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Submittals: Section 01300.

B. Basic Electrical Requirements: Section 16010.

C. Basic Electrical Materials and Methods: Section 16050.

1.2 DESCRIPTION

A. Provide underground telephone system to equipment locations as indicated on Drawings.

B. Provide system of empty raceways, boxes, terminal cabinets, etc., as indicated on Drawings for installation of telephone wiring and equipment by local Telephone Company.

C. CONTRACTOR shall coordinate with Telephone Company for telephone service installation and include the installation cost in the bid.

1.3 QUALITY ASSURANCE:

A. Conform to requirements of serving utility and National Electrical Code (NEC).

2. PRODUCTS

2.1 MATERIALS

A. Raceways, Fittings, Boxes, Cabinets and Finish Plates: Section 16050, Basic Electrical Materials and Methods.

3. EXECUTION

3.1 INSPECTION

A. Verify location of all telephone outlets with OWNER prior to roughing-in.

B. Examine area to receive terminals and equipment to assure adequate clearance.

3.2 INSTALLATION

A. Verify installation requirement with serving utility. Stub conduit up nominally six inch above floor or below ceiling at terminal facilities provided by telephone company and lock into metal template with locknuts and insulating bushings.

B. Underground Service: Conduit from terminal location inside building to telephone conduit beyond building. Other exterior raceways as indicated on Drawings.

C. Conduit bends to be large radius field bends or factory ells. For wall outlets at frame or metal studs, place telephone connector inside wall cavity and not in surface mounted box located over telephone outlet. Through wall box and conduits at these locations to be properly supported.

D. Wall Outlets:

1. For concrete or masonry walls, minimum of four inch square with two gang device cover finish plate.

2. For frame or metal stud partitions or where outlets are located in blank panels of casework, provide four inch square through wall box 1-1/2 inch deep with open back and two gang device cover finish plates.

3. Provide and install minimum 3/4" conduit from outlet boxes to ceiling cavity. Stub-up, label and cap for future extension of phone conductors.

E. Provide pull-in line in all empty raceways.

END OF SECTION